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Present Panama Conditions.

While it is undesirable to discuss the existing features of the situation in the canal zone on the Isthmus of Panama or to set forth the general features of any proposed plan in such a way as to pre-judge the decision of the Board of Consulting Engineers of the Isthmian Canal Commission, The Engineering Record has constantly held in view the legitimate interest of engineers in this project and on a number of occasions it has expressed certain general views that, in its opinion, should guide the deliberations of both those bodies. In pursuing this course this journal has from time to time secured the fullest possible information regarding the progress of the work and such features of the situation as bear upon the general undertaking, including both structural and sanitary matters. The recent return from the isthmus of members of the Commission and of the Consulting Board marks an important juncture in the history of the enterprise, especially as it is admitted by the Board itself that its report will be made to the President not later than the early part of December.

It should be borne in mind that the functions of the Board of Consulting Engineers have been designated by the President as of a purely consultative character. In other words, that body has been designated to review and pass on such plans as may be submitted to it by the present Commission or by other parties through that body. It appears, however, from the published letter of transmission from the Commission to the Board, over the signature of Mr. Shonts, the chairman of the former body, that the Commission has formulated no plans of its own and has presented to the Board only the tentative plan of the old Isthmian Canal Commission of 1899-1902 and other papers relating to the general canal problem emanating from the former French companies, besides the proposed plans of Messrs. P. Bunau-Varilla and Lindon W. Bates. The presentations of the latter two plans have been made to the Board, as is well known, but no intimation has been given as to the views entertained by the Board regarding them. Nor for that matter is anything known of the impressions made upon the members of the Consulting Board by their actual examinations of the conditions now existing along the canal line. As has been indicated by the chairman of the Commission no actual work on the canal proper, even at Culebra, has been in progress since early in July. It is understood, however, that a large amount of work of preparation has been and is now in progress, as has been the case since the Commission as a body was created a year ago last March.

These conditions give rise to some interesting and important reflections, which may properly be set forth at this time. Inasmuch as the Commission has transmitted to the Consulting Board no plans of its own nor even plans for which it has expressed any degree of preference, unless indeed its positive disapproval of any sea-level plan may be classed in that category, it seems almost inevitable that the Consulting Board must assume creative functions and elaborate plans of its own, except possibly in the case of its adoption of the preceding Commission's tentative plan or one of those advocated by outside parties. For obvious reasons it seems scarcely probable, in the light of investigations completed during the last year and a half, that either of those alternatives will be followed. It is a fair presumption, therefore, that the report of the Board will set forth the main features of some plan or plans of its own. Under these circumstances it is fortunate that the membership of the board includes such a wide range of experience in lines of engineering design and construction either identical or affiliated with great canal and harbor works.

The elaboration, even in skeleton, of a plan of an isthmian canal in the period assigned to the operations of the Consulting Board is a work of great magnitude and out of proportion either to the time allowed or to the financial return for services set forth in the President's published order. It involves not only a decision as to the type of canal to be built, but also a careful general consideration of a number of great appurtenant works, including the greatest locks ever constructed as well as costly terminal and harbor works.

The canal itself has been a subject of such absorbing interest that some of the main subsidiary features have been quite overlooked, although they involve operations of unusual magnitude. As a matter of fact no adequate harbor plans have ever been elaborated for the Caribbean end of the canal nor has the Pacific terminal itself, a problem of much simpler character than the other, ever received adequate treatment. The bay of Panama is subject to no serious storms whatever, indeed the opponents of the Panama route have always reproached it as possessing practically no wind at all. Limon bay, at the northern terminus of the canal, on the other hand, is subject at rather rare intervals to storms of great violence. While these storms seldom aggregate more than two or three days in the year they are of such intensity that protective harbor works of magnitude must be designed and constructed for that entrance of the canal. If a lock plan should be adopted, the locks under the terms of the law governing the deliberations of both the Board and the Commission, would be great structures of the kind, probably not much under 1,000 ft. in available length. The construction of such locks will bring into existence questions of great engineering interest as well as of commercial importance, and they must receive most careful treatment by the Board, the Commission apparently having taken no action in regard to them or to other features of a canal plan.

Taking all the conditions of the case as it exists at the present time it seems pretty clear that the Consulting Board has resting upon it extraordinary responsibilities, and as its functions have apparently been changed from consulting to creative it has a great work to be performed in a short time. Its composition and general character, however, are an assurance that the work will be thoroughly done. It cannot fail to be a matter of the greatest professional interest to engineers to receive the final verdict upon this great engineering question, which has received serious attention for about four centuries, even should there be a divided judgment as to sea-level and lock plans.

The Magnitude of the Additional Water Works for New York City.

In the Current News Supplement of this journal for Oct. 14 there was printed an abstract of the report of Chief Engineer J. Waldo Smith to the Board of Water Supply of New York City, describing the works which are considered best adapted for furnishing water to the metropolis. The enormous extent and cost of the works make it surprising that comment on these features of them has not appeared in the daily press. The improvement of the State canals and the construction of the New York terminals of the New York Central and Pennsylvania railroads, so much discussed in newspapers and magazines, are not so costly as this enterprise of a single city, and even the great Panama Canal, if Congress decides to confine its cost to $200,000,000, as is now the law, is not so very much more expensive than the $162,000,000 project proposed for furnishing 500,000,000 gal. of filtered water to Greater New York. Moreover, outside of the one great drawback of climate at the Isthmus, there are good reasons for considering the canal as little more difficult than the works to furnish this additional water supply. The construction on the Isthmus will be concentrated along a line every part of which can be reached by railway; the reservoirs and aqueduct west of the Hudson must be built in a mountainous region which will render the transportation problem a difficult one and its solution costly. The aqueduct alone, from the great reservoir at Ashokan to the service reservoir at Yonkers, will have 29 miles of tunnels, 37 miles of conduit built in trenches, and 16 miles of riveted steel pipe line, including a submerged crossing under the Hudson River.

One reason for the great cost of these works is to be found in our legal restrictions preventing any logical utilization of interstate streams. The natural source of additional water supply for the city is to the north of the Croton drainage basin, but unfortunately the runoff from that region flows into Connecticut and so it cannot be developed for water supply purposes for New York. Other sources on the east bank of the Hudson are forbidden to the city, except under conditions it was considered inadvisable to accept, and consequently it has been necessary to go to Ulster County. The city has had to face both geographical and legal obstacles of an unusual character, and it must consider itself fortunate that such a satisfactory solution is practicable. The enormous expense of these works is not in any sense unprecedented. It is inevitable that the cost of works to bring water from a distant point will be considerably greater per unit capacity than the cost of earlier and smaller works. Statistics compiled by the engineering department of the Board of Water Supply show that this difference will not be very great in the case of the Croton and Catskill supplies. The cost of building a reservoir and aqueduct capable of delivering 250,000,000 gal. to the city is estimated at $429,000 per million gallons capacity; if the works are completed as proposed so as to furnish 500,000,000 gal. of filtered water to all boroughs of the city, the unit cost will fall to $324,000. In the latter case the aqueduct from Ashokan to Staten Island will be 117 miles long. In comparison with these figures may be quoted the unit cost of $313,000 for the new Croton works, with a 31-mile aqueduct, and the unit cost of $200,000 for the Metropolitan works in Massachusetts, with aqueducts 25 miles long.

The plans of the Board must be approved by the Board of Estimate and Apportionment of the city and the State Water Supply Commission before construction can begin. The opposition in the city to the project is not likely to amount to much, but there is a prospect of some organized objection in Ulster county. It has been estimated that at least one hundred thousand summer visitors to the region of these new works will be driven away during the period of their construction. This is probably a grossly exaggerated estimate. Instead of detracting from the residential character of the country these works will improve it. Under the sanitary regulations which will be enforced, visitors to the region will be assured that the principles of hygiene are respected by all property owners, something they must take for granted at present, and it is practically certain that the character of the district will be so raised under the administration of the Board of Water Supply that the summer influx of visitors will be materially increased. In fact, it is difficult to see any reason for serious opposition to the works from the people of Ulster county while there are several strong reasons for welcoming their construction.

Air Space in Grates.

It would be very interesting to compare the views of different engineers concerning the proportion of air space a grate should have to give the most economical results. The common standard proportion of air space in good practice is 50 per cent.; that is, the space which would result from making the width of the metal bar and those of each of the contiguous openings equal. Perhaps it is stating the case too strongly to say that 50 per cent. air space is a standard, for the matter has not been settled by any authority. There seems, however, to be an understanding that a grate which contains this percentage operates in a proper manner, and there the question rests.

It is well recognized that the quantity of coal burned on a grate depends not so much on the total surface of the grate as on the total area of air space, for the same grate with an increased amount of air space will burn an increased amount of coal. The fact is not recognized, however, that with the same grate surface and the same rate of capacity, the spacing has a noticeable influence upon the efficiency of combustion. Although not generally recognized, there is evidence in boiler experiments to show that this is a fact. In Mr. Geo. H. Barrus' book on "Boiler Tests," for example, reference is made to a comparison between two tests of the same boiler, in one of which the grates had 50 per cent. air space, and in the other 60 per cent.

In tests of this boiler with anthracite coal under the same conditions, there was a noticeable difference of economy in favor of the grates with the smaller air space; and this held true with widely different rates of combustion. There are other reports of trials which point in the same direction. One case was that of two boilers, side by side, one of which had plain grates and the other shaking grates, the latter containing considerably less air space than the former. With semi-bituminous coal and practically the same working conditions, the boiler with the grates having the smaller air space gave the higher economy. In still another case, where semi-bituminous coal was used, tests were made on the same boiler with a difference of 20 per cent. in the proportion of air space, and quite a marked difference was noted in the economy, the better result being obtained with the grates having the smaller proportion of air space.

In all these cases the reduction of the air space in the grates improved the economy of the boiler. The same effect has been observed when the supply of air to the ash pit is reduced by partially closing the ash-pit doors. It has been noticed that an expert fireman, when operating a boiler for the highest economy, as under the conditions of an important contract test, zealously guards the amount of opening of the ash pit doors and restricts this to the lowest extent practicable. The same thing has been insisted upon as a necessary practice in connection with the operation of certain boiler appliances, where it was evidently desired that the credit due to the appliance should be enhanced by whatever improvement in the boiler could be produced by this expedient.

If the proportion of air spaces in the grates has an appreciable effect on the economy of a boiler, as appears from these statements of results of tests, the question arises as to what are the causes of this action. Three possible explanations were suggested in The Engineering Record about eight years ago. One is that when the air space is restricted a larger amount of air is carried into the furnace through the cracks around the fire doors, the register openings in them and any other openings which there may be in the boiler front. With the increased air supply above the burning coal there follows a better combustion of the gases, and in this way the efficiency of the furnace is improved. The second explanation is that with the restricted air space a smaller volume of air finds its way through the coal, and the amount of surplus air over that required for combustion is reduced; consequently less heat is carried off to the chimney flue. There is still another explanation which may have some weight; it is that the reduced air space may serve to keep the bed of coal at a higher temperature, and in this way produce a more perfect combustion.

This question of the size of air space is a subject it is impossible to investigate mathematically, and it will require a large amount of experimental work before a law can be formulated governing any particular type of boiler. In fact, it is doubtful if the results obtained on one design of boiler or grate can be applied exactly to any other. Nevertheless, the information obtained from one series of experiments, properly conducted, would certainly be of no little value to boiler engineering in general. It seems as if the matter is of enough interest and importance to be carefully investigated.

Highway Improvements and Grade Crossing Elimination.

Next month the voters of New York State will express their opinion on an amendment to the Constitution reading as follows: "A debt or debts of the State may be authorized by law for the improvement of highways. Such highways shall be determined under general laws, which shall also provide for the equitable apportionment thereof among the counties. The aggregate of the debts authorized by this section shall not at any one time exceed the sum of fifty millions of dollars. The payment of the annual interest on such debt and the creation of a sinking fund of at least two per centum per annum to discharge the principal at maturity shall be provided by general laws whose force and effect shall not be diminished during the existence of any debt created thereunder. The legislature may by general laws require the county or town or both to pay to the sinking fund the proportionate part of the cost of any such highway within the boundaries of such county or town and the proportionate part of the interest thereon, but no county shall at any time for any highway be required to pay more than thirty-five hundredths of the cost of such highway, and no town more than fifteen-hundredths."

It has already been pointed out that this proposition is not one which involves a large appropriation by the present generation for the benefit of generations to come, like too many of such projects, but simply carries forward the object of the present State aid legislation by lending the assistance of the State's credit in raising money. It is hardly necessary to go over this feature of the proposition at the present time. Another aspect of it has been raised, however, by certain railway interests, which claim that at least a portion of the money should be paid for the elimination of grade crossings. This may seem at first sight merely another exhibition of railway nerve, but a little reflection will show that the railways have some sound arguments on their side of the question.

The average railway in New York State was constructed at a time when the country roads were few and far between. Many of these railways have only reached their present condition of relative prosperity after passing through foreclosure proceedings of considerable variety. Their original construction depended on securing a cheap line and their operation for many years was a hand-to-mouth business. If they had not been constructed the districts they served would have been delayed in their development. Under the conditions existing in those days the elimination of what few grade crossings there were was thought of by neither people nor railway officers. When new roads were laid out nobody cared that they crossed the tracks at grade. In consequence such crossings multiplied very fast, and in course of time, with greater train speeds and many more crossings, accidents became unfortunately frequent. It was then claimed that these accidents were the result of railway carelessness and that grade crossings showed a disregard of public safety that was terrible to contemplate. Both these allegations are untrue; most crossing accidents are due to the carelessness of those attempting to cross the tracks, and most grade crossings were made by town and village authorities after the railway was located.

Leaving aside the fact that most of the expense of removing grade crossings ought to be paid by the public authorities, for the reasons stated, it will be admitted by everybody that such crossings are a menace to public safety. They are a danger to the operation of trains and to people crossing the tracks. They are not tolerated in Great Britain nor in the neighborhood of important cities in Germany and France. The more quickly they are eliminated here the better off everybody will be. Of late years the State and towns have each spent about $100,000 annually on such work, and the railways have been required to spend at least $200,000 more. As a matter of fact, they have spent considerably larger sums, without waiting for State aid for one-fourth of the expense. It is now proposed that of the State appropriation of $50,000,000 which the proposed constitutional amendment provides, one-tenth shall be used for the elimination of grade crossings. This sum of $50,000,000, plus an equal contribution from towns and villages and double the amount from the railways, will be sufficient to remove all the dangerous crossings in the State.

Inasmuch as no comprehensive road improvements can be made until grade crossings are removed, and as most of these crossings were probably made after the railways were built and were due to the action of the public authorities and not the railway itself, it would seem that there is very much sense and justice in the argument for this use of a tenth of the proposed appropriation.

Buying Coal.

The growing tendency to regard the present methods of purchasing large quantities of coal with suspicion is most gratifying. When an engineer buys cement in large quantities he provides for testing it before acceptance, when he buys steel the same is true, but when he buys coal the choice is made because somebody else has done so, because the salesman does not wear a red tie, or any other equally foolish reason. The fact that coal should be bought on a guarantee and samples taken from deliveries to assure the maintenance of quality is just beginning to be appreciated, possibly because it is now recognized that the commercial examination of fuel is a regular business with some analysts and is not at all expensive in comparison with the loss in value which may attend the delivery of fuel not up to sample.

The importance of this matter can be quickly demonstrated. Take two coals having 14,000 and 10,000 B. t. u. respectively. One is worth nearly half as much again as the other for raising steam, and the difference in the fuel value is only one factor in the relative merits of the two grades. There are the charges for shipping the coal, the cost of removing ashes, the labor of stoking, the losses of heat in the greater amount of ashes and other items of the same sort, which are rarely taken into consideration but ought to be. In some cases the matter of storage capacity for fuel will have some weight in the selection of the proper grade for use in a given plant. The type of boiler and its surroundings must also be considered. All of these factors are not indicated by an analysis of samples of coal, but a great deal of help in their consideration can be obtained from its results.

Lest it should be thought that these observations are more theoretical than practical, attention is called to the following opinion expressed by Mr. W. L. Abbot, chief operating engineer of the Chicago Edison Co., a few years ago: "The greatest possibilities for saving or wasting about a steam plant are undoubtedly in the coal pile, but as it is a dirty proposition and many of its features not well understood, the subject does not receive the consideration to which it is entitled. The average ambitious engineer or superintendent will spend much time and care on his engine to be sure that the indicator cards are perfectly symmetrical, that the points of cut-off are equal, that the release is in time and that the compression rises to meet the admission in a smooth round curve. This is proper and commendable, yet the same time spent in studying the conditions of combustion in his furnace might show him a way to make a saving in fuel fourfold greater than is possible in the final refinements of the indicator cards. When we consider that $100 saved is $100 added to the surplus, which is as good as $500 increase in the gross receipts and that, to add $500 monthly to the gross earnings would require an investment of say $25,000, when we consider this we may realize what a valuable asset is an engineer who is prolific in methods for keeping cost down, or is ready to adopt such methods from others."

Another proof of the importance of the subject is to be seen in the model gas works of several million feet capacity built in a number of foreign cities expressly for the purpose of testing gas coals. Fortunately for the steam engineer he does not need such an expensive testing apparatus. A proximate analysis showing the percentages of moisture, volatile combustible matter, fixed carbon and ash, and possibly the sulphur, combined with calorimeter determinations of the heat value, furnish all the data required to judge of the quality of steam coal. These tests are readily made and if there is any question about them it is usually not very troublesome to run a boiler test for a short time. As a matter of fact the agreement between the boiler tests and the results of the other determinations, when both are made carefully, is very close, close enough for all practical purposes.

It might be well to add here the reason for mentioning this subject at this time. During a recent visit to a large building in which the amount of coal burned annually must run up to a large figure, the engineer let slip, in a moment of forgetfulness, his real opinion of the coal he was employing. His statement concerning the unnecessary work involved in stoking and ash handling was decidedly pointed. As a matter of curiosity a little time was spent to ascertain why such coal was burned. It was learned that it was bought by the agent of the building, who also bought the coal for many other structures of which he was in charge. The purchasing was done by a youthful employe who probably had never heard of heat units, let alone their importance in fuel. On the other hand, he did accept the lowest tender every year, which came from a firm whose local agent was a close personal friend of the young buyer. Nominally, he was accepting the best offer, when in reality he was getting coal good for little more than a bonfire on election night.

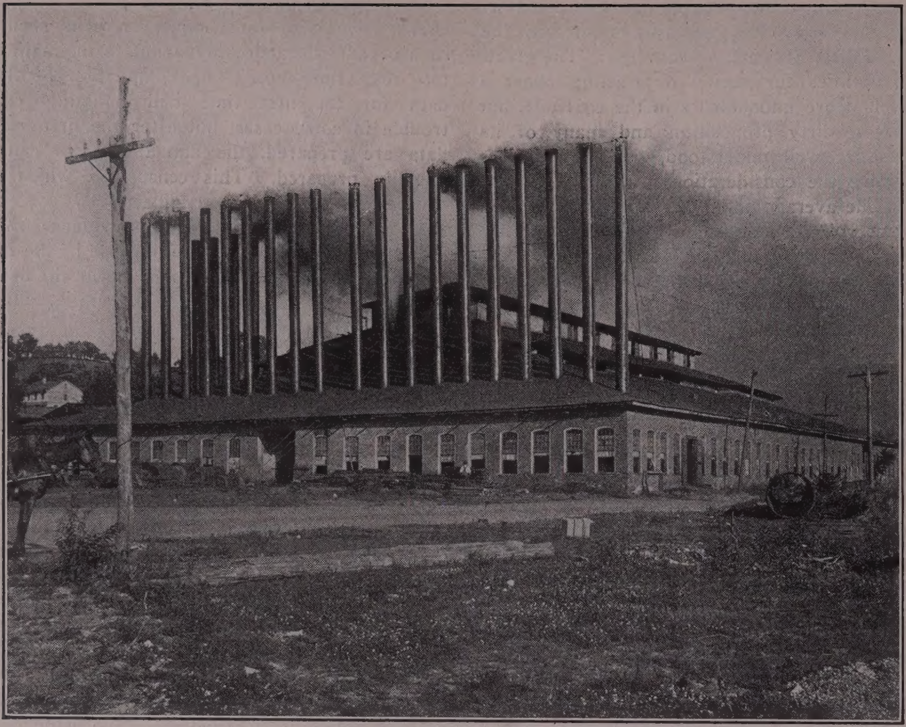
Notes and Comments.

Water Supply and Sewerage Statistics are being collected by the State Water Supply Commission from all the communities in New York. This task is a heavy one, but it must be executed if the Commission is to carry out the objects for which it was constituted. There are 45 cities, over 400 villages and over 1,200 towns in the State, and over 200 private water companies. In many cases there are probably only meagre existing records of some of the works concerning which statistics are desired, for the Commission has wisely asked for complete returns such as each organized community ought to maintain but too often does not. The compilation of these data for the first time will doubtless cause trouble in some cases, but after the first set of data are prepared, the annual returns can be speedily prepared. This census, in which the Commission's consulting engineer, Dr. Myron S. Falk, is taking a leading part, is evidence of the thoroughness with which the purpose of the Legislature is to be carried out, and merits the hearty support of the officers of all the cities, villages and towns of the State.

Mechanical Draft is strongly recommended for burning coal of low quality, by Mr. John W. Cobb. In a paper in the "Journal" of the Society of Chemical Industry he mentions a test with six Lancashire boilers working side by side with a common chimney. One had a fan-produced air pressure of 5 cm. of water under the grate while the others were running on a chimney draught of 15 mm. It was found that under mechanical draft 21 lb. of coal per square foot of grate was burned hourly with forced draft and only 15 lb. with natural draft. The difference in the composition of the flue gases was very small so long as the samples from the natural-draught boilers were taken while the firing doors were closed.

The Recent Development of the Country west of the Missouri River furnishes a good example of the broad-gauge methods of encouraging agriculture and industries followed by our leading railways. For example, the Industrial Department of the Chicago & North-Western Ry. has found at a town of 1,200 people in northern Nebraska an undeveloped water power estimated at 4,000 h.p., while there are deposits of glass sand, fuller's earth, clay, kaolin, fire clay and marl suitable for Portland cement in the vicinity. The department is now engaged in making known these unusual natural advantages, and it is safe to say that before long at least some of them will be developed, although without the work of the railway's bureau they would remain unknown for years to come. Incidentally it might be pointed out that the combination of abundant water power and glass sand running 98 per cent. silica offers a good opportunity to test the German process of making glass electrically, for which many important technical and financial advantages are claimed.

A Consolidation of Technical Societies which is considered likely to take place is the union of the American Gas Light Association, Western Gas Association and Ohio Gas Light Association into an American Gas Institute. The first-named body approved the project at its recent convention in Milwaukee, but it has still to be passed by the others. The arguments for the consolidation are, first, that the three associations now cover much the same territory, and, second, that their consolidation will reduce administrative expenses and increase the benefits which should be derived from membership in such an organization. There can be no question that the gas industry would be much benefited by a strong national organization, like the National Electric Light Association and the American Street and Interurban Railway Association. The American Gas Light Association has had its influence considerably diminished in the past by the self-sufficiency of some of its officers, who have adopted unfortunately narrow views concerning the way in which such an organization can be made strong. Consequently an amalgamation of the three leading organizations may result in a really national association.



Exterior View of the Compressed Air Station on the Kerbaugh Contract.

A CENTRAL COMPRESSED AIR POWER PLANT FOR HEAVY RAILROAD CONSTRUCTION.

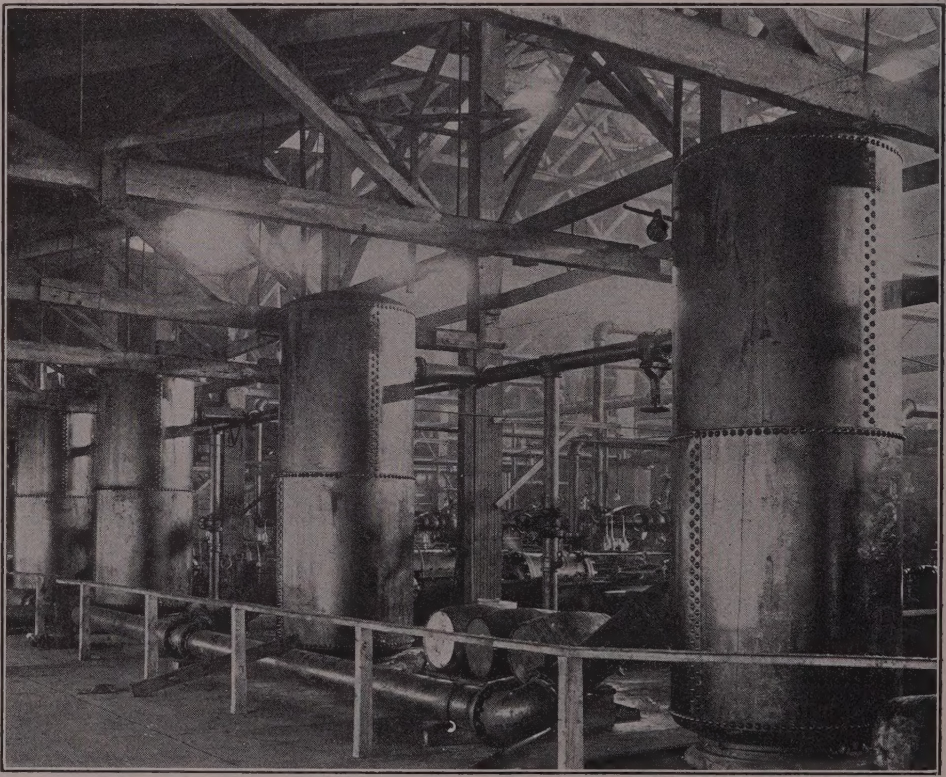
THE LOW-GRADE FREIGHT LINE OF THE PENNSYLVANIA R. R. NEAR SAFE HARBOR, PA.

By Lucius I. Wightman.

Some of the heaviest work in the history of railway construction is now nearing completion on the low grade freight line of the Pennsylvania R. R., paralleling the Susquehanna River in its course through the southern part of Pennsylvania. The plans now being carried out involve a double-track line at a height above the river which will avoid all difficulty from high water; and its object is to relieve the congested freight traffic on the main line, as well as to reduce the grades for the heavy freight hauls which mark this section of the road. Probably the most difficult conditions were met on a section about 9 miles in length, beginning on the north near Columbia, Pa., and reaching to Modic Fords on the south. Along this stretch the hills jut into the river with abrupt headlands of solid rock several hundred feet high and in many cases almost perpendicular. The work here has consisted of a continuous cut in solid rock; and the almost vertical hillside has made necessary the removal of vast quantities of rock with tremendous charges of powder, before the necessary width could be secured at grade. This section is especially interesting and noteworthy in that practically all the excavating machinery over the entire nine-mile line has been driven by air power supplied from a central air plant, located about midway of the work at the mouth of Conestoga Creek, near Safe Harbor. This is the largest piece of railway work ever carried on with air power from a central station.

The contractor for this work is H. S. Kerbaugh, Inc., of Philadelphia, and the air power system—the largest ever used on contract work—was installed under the direction of the Philadelphia office of the Ingersoll-Sergeant Drill Co., of New York. In the description of the system which follows it is to be remembered that the plant is essentially temporary in character and was installed with a view to later sub-division among minor contracts. This fact will explain many seeming irregularities in design.

Safe Harbor was selected as the location for the plant, not only because of its central location in relation to the work, but also because there was available at that place a large building which would be used for power purposes. This building, 160 x 260 ft. in size, is of brick and mill construction; it was originally a match factory, but was later used as a rolling mill. It has been made the headquarters of the mechanical department of the contract and in it are installed the boiler and compressor plant, the machine, forge, and carpenter shops, and the general storage warehouse. Near it are grouped the local executive offices of the company.



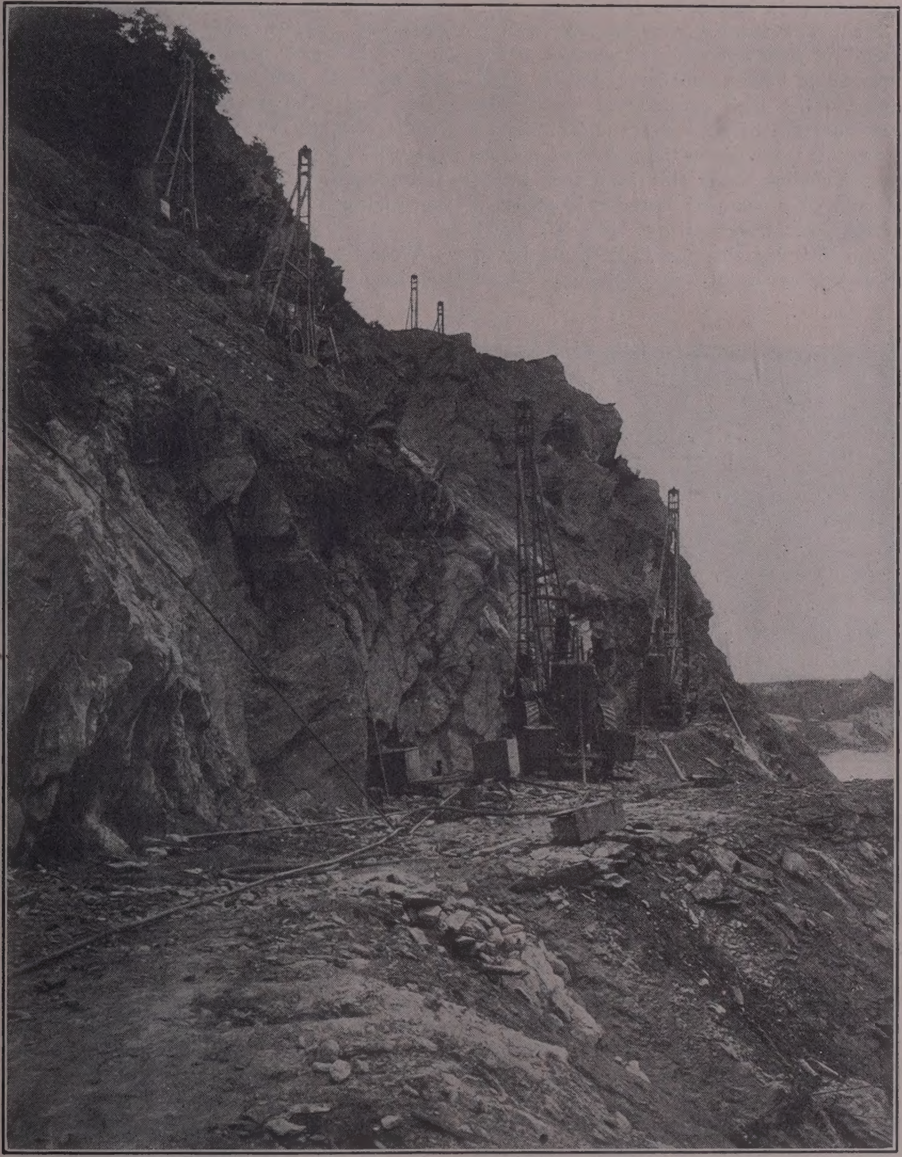
Receivers in Compressed Air Power Plant.

The boilers are arranged along the northern side of the building, twenty in one row, with a battery of four more facing them at one end. They are of horizontal tubular locomotive type, installed without settings, and rated at 100 boiler horse-power, thus giving a total steam plant capacity of 2,400 boiler horse-power. Each boiler has its own stack about 80 ft. in height, and the peculiar appearance of the power house resulting is seen in the accompanying illustration of the exterior. Coal is stored in an outside bin of about 5,000 tons capacity, and delivered to the fire floor by hand cars running on a track in front of the boilers. The plant is hand-fired, about 40 tons of slack coal being burned per day.

Water is delivered under a head of about 22 ft. to a cold well in the middle of the power house from a dam 2 miles distant. This cold well is the source of cooling water for the air compressors, as well as for boiler feed water. Three 10x7x10-in. duplex steam pumps are installed, one handling the boiler feed, one the circulating water for compressors, and the third being a reserve unit for either of the others, as well as a fire pump, in emergency. Water pipe connections are such that these three pumps are interchangeable in their functions. Feed water, after passing through a 2,000-h.-p. vertical exhaust-steam feed-water heater, is delivered to the boilers through a feed main laid in the rear of the battery, with independent branches to each unit. The steam pressure carried on the boilers is 100 lb.

There are two steam headers in the plant. One is the boiler header, paralleling the boiler fronts. This is a taper line, with a maximum diameter of 16 in. in the middle and reducing to 6 in. at the ends; the boiler risers are 6-in. pipe. The second is the main steam headers, paralleling the line of compressors. It, too, is a taper line, with a maximum of 16 in. in the middle and a minimum of 6 in. at the ends. The steam pipe to each compressor rises from the top of the header and is protected by an angle valve. Extra heavy flanged fittings are used throughout. The headers are supported by wrought columns rising from the floor and terminating in a saddle at the top. A 16-in. main unites boiler header and steam header, connected in at the middle of each.

The exhaust header parallels the steam header, and increases from 7-in. section at the ends to 20-in. section in the middle, from which point a 20-in. exhaust main leads to the header. A spiral riveted steel pipe rises from the heater to the exhaust outside. Each compressor exhaust pipe is fitted with a valve at the exhaust header.



Drill Rigs Used in Sinking Blast Holes for Railway Berme.

The air compressors constitute the major part of the load on the boilers, but steam is also supplied to the pumps, the machine shop engine, an electric lighting unit, and, in cold weather, to a fan engine for the shop heating system. The grouping of all these mechanical departments under one roof simplifies the problems of local power distribution.

The battery of air compressors is made up of eight units arranged with their shafts in a line at right angles to the line of boiler fronts. Each unit is an Ingersoll-Sergeant Class A straight line, single-stage air compressor, with a steam cylinder 24 in. in diameter, an air cylinder 24¼ in., and a stroke of 30 in. The normal speed is 80 r.p.m., at which each machine has a piston displacement of 1,223 cu. ft. per minute, giving a total air capacity of 9,784 cu. ft. per minute delivered at 95 lb. pressure. These compressors are controlled by the Sergeant "Air-Ball" speed and pressure regulator and fitted the Sergeant piston inlet valve; discharge valves are of standard direct-lift type and the air cylinders are completely water-jacketed on heads and barrel. The units are mounted on independent masonry foundations, 12 ft. apart, center to center. Compressor discharge pipes lead to a 6-in. air header, each being protected by valves so that any machine may be cut out. There are four vertical air receivers, 60 in. in diameter and 14 ft. high, arranged in a row in the rear of the compressors. Their discharge pipes connect with a 12-in. air main leading outward to the line. Proper provision is made for drainage of entrained moisture.

Outside the power house the air line branches. An 8-in. main, laid on the eastern side of Conestoga Creek, leads a distance of 3,250 ft. to the scene of work below. This main supplies the eastern half of the contract. The second branch of the 12-in. pipe crosses the creek on a cable suspension, and runs thence over the hills on the west side to the railway cut. This latter line supplying the western section is 3,650 ft. long. The pipe lines reduce in size as greater distances are reached, until at the extremities of the section a 3-in. main supplies the machines. The pipe is laid on the surface following the contour of the country. Screwed joints are everywhere used, except that every 500 ft. a flange joint is introduced to simplify installation. Every 400 ft. along the line of work a 3-in. branch tee is inserted in the main pipe, from which a 3-in. branch main is carried down the face of the hill to the work below. Expansion and contraction are provided for by swing joints in the pipe line, made up of four elbows, two nipples and a short length of pipe. These are placed wherever the pipe turns a corner, and on straight runs where it is deemed advisable. Provision is made at every low place on the line for the removal of water through drain cocks. In all there are about 40,000 ft. of main pipe line with countless branches and sub-branches. The largest direct transmission is 28,650 ft., or 5.4 miles. This great length provides an enormous air storage capacity in the system and obviates all minor fluctuations of pressure due to varying load. There is no measurable drop in pressure along the main line; but the ill-advised use of pipe too small in some branches has in places caused a very serious lowering of pressure on the machines.

The method of excavation has been that of drilling a number of very deep vertical holes along the inside of the desired cut, and a series of "snake holes" of a suitable depth on a level with the bottom of the vertical holes. These holes were "sprung" by a charge of dynamite, then loaded with blasting powder; and the entire series discharged at once by an electric current from the central plant. Enormous charges were used and great quantities of rock dislodged. In many instances the major part of the mass was thrown into the river and required no handling. Loose rock remaining was loaded in cars by chain shovels or hand and run back over a light railway to suitable dumping places, but fills are remarkably infrequent.

A novelty in this work has been the use of thirty-four heavy well drilling machines for the deep vertical holes. These were of the ordinary steam-driven type, with engine, boiler and driller mounted on a wheeled truck, but compressed air was the motive power. Two sizes were used, designated as 26-ft. and 30-ft. machines. In practice the driller was properly located and a branch pipe from the air main connected by a length of hose to the boiler, which thus served as a secondary receiver. No changes were necessitated in the machine itself by the use of air power. The hole drilled by this arrangement was 5½-in. in diameter all the way down, and varied in depth up to 135 ft. It was a serious matter, in the majority of places, to get these well drillers down to the work, owing to the precipitous character of the country, but in every case the engineers were successful. The illustrations give some idea of the difficulties encountered.

The horizontal or "snake holes" were drilled by standard rock drills, about 250 of these machines having been used on the work. All of them were of the arc valve tappet type built by the Ingersoll-Sergeant Drill Co. Owing to the depth of the holes required, these drills were of the heaviest type, with cylinders 3⅝ in. in diameter. The tripod mounting is used exclusively. The holes drilled varied in depth up to a maximum of 35 ft. The deepest holes were 4½ in. in diameter at the top and diminished to 1⅝ in. at the bottom. It will be readily appreciated that only the heaviest and most powerful drills could work effectively with such long, heavy steels as this work demanded. The rock has varied in quality, but the average has been of a hardness rather above the ordinary. The service has not been easy on the machines. The average work of each drill has been from 40 to 60 ft. of hole per day, including the necessary delays due to changing steels and moving. This rate is reported by the contractors to be double that secured where steam was used, on an earlier stage of the work. In this connection it is interesting to note that at one time it was attempted to use steam supplied from boilers located on the top of the hill and piped to the drills below, but it was found that condensation was so great as to give practically no pressure on the drill and the scheme was abandoned. Air power was found to be the only solution of the problem.

There have been sixteen blacksmith shops scattered along the line of work in which the forges were blown by a small air blast from the main line. Air pressure has been used all along for clearing out the deep holes. There are three 6x4x6-in. duplex pumps on the line, also air-driven from the main plant, raising water from the river to tanks on the bluffs above. There have also been on the work at different times ten 6x8-in. duplex hoisting engines which were driven by air from the common supply, but as the work progressed and drills were added, it was found that these machines required all the air that the compressor plant could furnish; and so individual boilers were installed at each hoist. These latter are now used on the bridge work at the mouth of Conestoga Creek, where a steel bridge is being erected which will have a height at the rails of 140 ft. above the normal river level.

Along with the heavy rock drills used for the deepest holes, a few small machines have been used on the lightest work. These were "Little Jap" hammer drills built by the Ingersoll-Sergeant Drill Co., light hand machines similar to the ordinary pneumatic tool. Their use in this work is interesting. Previous to their introduction, it had been the custom in "mud capping" to explode a case of dynamite on the surface of the rock. Later a hole 6 in. deep was drilled with a "Little Jap" and charged with a single stick of dynamite. This was found to do the same amount of shattering that a full case did before, with a great saving of explosive.

Steam shovels were used extensively in removing the rock broken by the blast. They were supplied with steam from their own boilers, but in one instance at least a shovel was connected up to the air line and air power was applied both in removing the rock and in moving the shovel itself. Air power would probably have been applied in the shovels more extensively had it not been found that the drills required practically the entire output of the compressor plant.

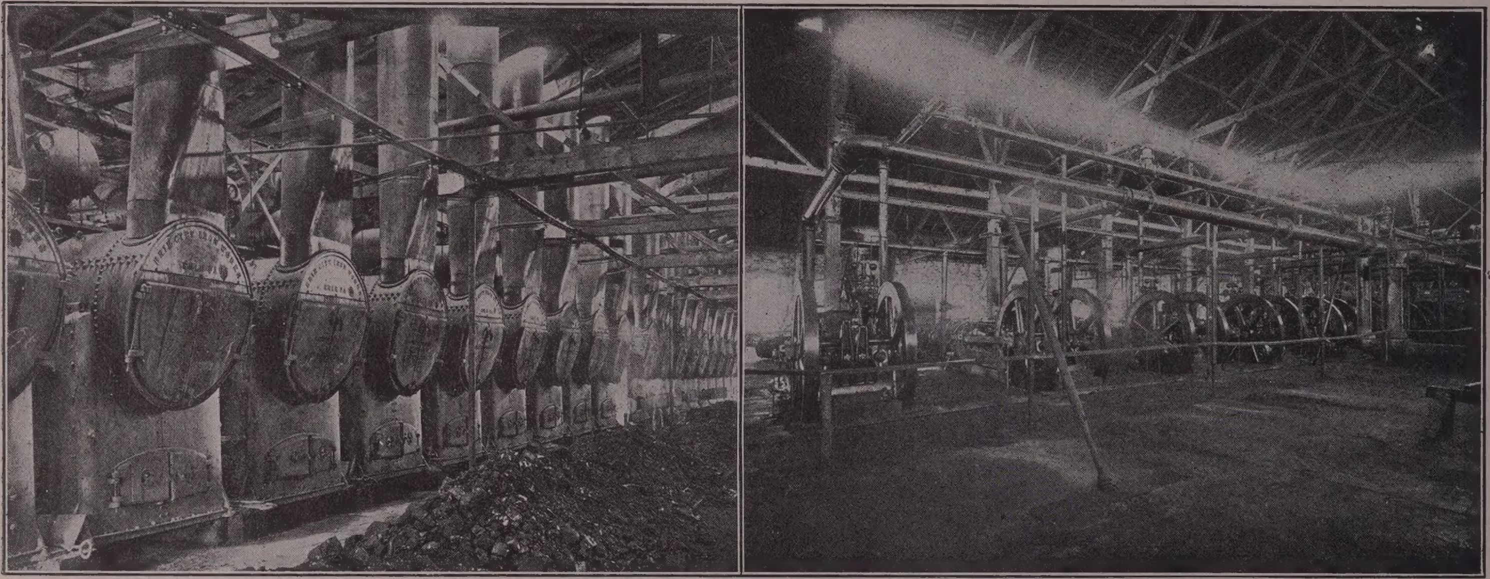
A statement of the data on the air power at this plant may be convenient at this point, as a resume of the description: Total free air capacity, 9,784 cu. ft. per minute; total boiler horse-power, 2,400; air pressure, 95 lb.; total load 250 3½-in. drills (150 at work on the average), three "Little Jap" hammer drills, 34 well drillers, three 6x4x6-in. duplex pumps, sixteen blacksmith forges, one steam shovel, ten 6x8-in. duplex hoists (later run by steam) cleaning drill holes.

It was shown beyond question that steam could not be used for the drills on this contract. This alone would determine the choice of power under like conditions, and in the present case compressed air was adopted very largely on this account. But there are other advantages which, in combination, have resulted not only in great effectiveness, but high efficiency as well. The greatest difference between steam and air-driven plants for this work lies in the matter of operating cost, including under this head fuel, maintenance and labor charges. Running by steam, a fair average would be a 75-h.-p. boiler for every ten drills, assuming that ten drills could be so located as to draw steam from one boiler. There would thus have been required at least twenty-five 75-h.-p. boilers for drills alone; in all probability there would have been more. Each pump would have required its own boiler. The thirty-four well drillers, steam-driven, would have called for that many more boilers. With the present equipment there would thus have been required at least 62 separate and scattered boilers. To each of these coal and water must have been delivered. The drill boilers must have been removed from time to time as the work progressed. The small boilers of uneconomical type and wholly unprotected would have had an excessive fuel consumption, and moreover, they would have been exposed to a heavy depreciation, calling for heavy and repeated repairs. The distribution of coal and water to the scattered boilers would have kept a large labor force busy and increased the cost of fuel and water. At each drill and pump boiler an attendant would have been required.

All in all, it is seen that an outfit of steam plants with a work capacity equivalent to that of the present air plant would have multiplied fuel, water and maintained charges many times over that of the present plant, besides largely increasing the labor force.

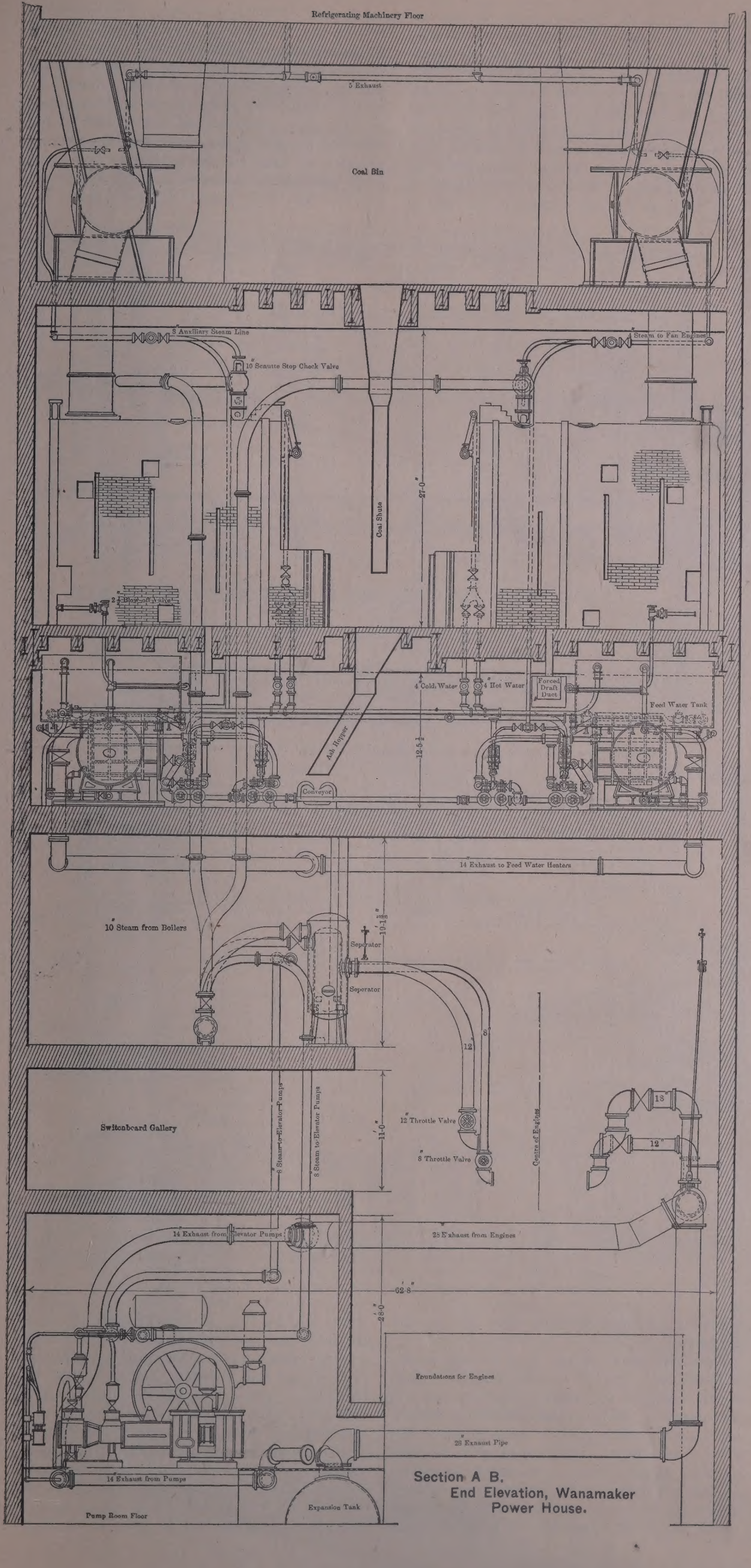
On the other hand, the centralized air plant, with its single large boiler equipment and compact compressor outfit, reduces fuel attendance and labor charges to the limit. Boilers of more modern type, compressors of higher steam economy, and more correct station design would have given much higher plant efficiency, but the fact that the system was only temporary forbade elaborate design and the multiplication of small units permits their transfer as individuals to other points on subsequent contracts. Even as it stands, this plant is a remarkable instance of high-grade engineering applied to temporary demands.

The use of air power, furthermore, is equivalent to an increase in the length of the working day. For if steam had been used, time would have been lost each day in waiting for steam to be raised. Frozen pipes would have had to be thawed in winter, involving further delay. During all these little waits, men would have been idle. Under the present system, power is everywhere instantly available, and every minute of the working day is effective; every man does his full quota of work, in so far as that is dependent upon power supply.



Boilers and Air Compressors in the Plant of H. S. Kerbaugh, Inc., near Safe Harbor, Pa.

Wood Pulp Flooring, which has come into extensive use in Germany, is made of made of pulverized wood fibre and other materials, varying with the brand. In a report from ex-Consul-General Mason at Berlin, it is stated that doloment, which is typical of this class of substances, is made of wood fibre, asbestos, mineral substance and pigment to give the desired color. German floors are almost always made of concrete, and when doloment was first used it was found to crack if the concrete cracked for any reason. Consequently the concrete is now covered with a thin layer of fine cork chips, asbestos, sawdust and some binding substance. On this is laid the flooring material itself, in a ½-in. course. The partly elastic binder course not only prevents cracking, but also acts as a heat insulator and sound deadener. This new construction is extensively employed in German industrial works, and samples of the material may be seen at the Bureau of Manufactures, Department of Commerce and Labor, Washington. It might be added in this connection that another German material of this nature, known as asbestolith, has been made for a number of years from Georgia short-fiber asbestos. The owner of this source of asbestos supplied a large quantity to German purchasers before he found out what it was used for.



Section A B.
End Elevation, Wanamaker Power House.

The Power Plant for the New Wanamaker Store, Philadelphia.

The power plant for the new twelve-story department store of John Wanamaker in Philadelphia has many interesting features of design and arrangement. It supplies electrical power for lighting and motors, steam, compressed air and water for the new building and is located a block distant, so as to remove the objectionable features of vibration, heat and odor, inevitable in power generation, from the store itself. Furthermore, an arrangement of power plant on a ground space measuring only 66x90 ft., which provides for over 4,000 kw. in electrical generating apparatus, 5,300 h.p. in boilers located on the fifth floor, a 650-ton coal bin on the sixth floor and a refrigerating plant on the seventh floor, cannot fail to be of interest. The structural details of the power house building, which involve many radical and unusual features, have been described in full in articles in The Engineering Record of July 22 and 29, 1905, and the present article takes up only the mechanical equipment.

The building is a seven-story structure 165 ft. high, of steel-cage construction, with a liberal use of concrete for fire-proofing, and is of a remarkably heavy design in order to provide for the weights carried on the upper floors. The lower story is 62½ ft. high and divided by a longitudinal wall into an engine room and a pump room, there being above the latter, however, two intermediate or mezzanine floors below what is nominally the second floor, while above the engine room floor is space for a 10-ton crane. This second floor is devoted to the boiler auxiliaries and the third main floor, or in reality the fifth, to the boilers. The floor above the boilers carries the coal and ash bins, while the top floor is devoted to the refrigerating plant. The floors are in general made of reinforced concrete flat slabs and arches, and the concrete is extended to enclose and fire-proof all the floor beams and girders. The roof is of concrete on segmental tile arches sprung between I-beams. The connection with the store building is made through a tunnel 8x12. ft. in section and about 180 ft. long.

Boilers.—There are eight Babcock & Wilcox water-tube boilers, each of 663 h.p. rating, which supply steam for the operation of the engines, direct-connected to the generators, to the pumps and for the heating system. These are located on the third main floor, 60 ft. above street level, which is heavily strengthened to carry the weight imposed, amounting to 1,840 tons for the eight complete boilers and their settings, and are set single with a passageway on either side. The floor of the boiler provides room for the furnace construction, the ash hopper and forced draft connections without waste of space, heat insulation being provided by vitrified asbestos in 2-in. layers throughout. These details were illustrated in the previous articles above referred to. The boilers are arranged in two longitudinal rows, one on either side of the building facing a firing aisle between them, to which the coal is delivered from the bunkers above by chutes. This floor is covered with thin checkered cast-iron plates to give a better foothold.

The boilers are of the inclined wrought-steel, water-tube type, supplied by Babcock & Wilcox and are designed for 200-lb. steam pressure. They are fitted with hand-fired Treadkill shaking grates with 4-ft. extension furnaces for burning anthracite coal. Each boiler is made up of three 42-in. steam drums and has 294 4-in. tubes, 18 ft. long and arranged 21 tubes wide and 14 high. The heating surface provided is over 6,600 sq. ft., and the grate area is 100 sq. ft. per boiler.

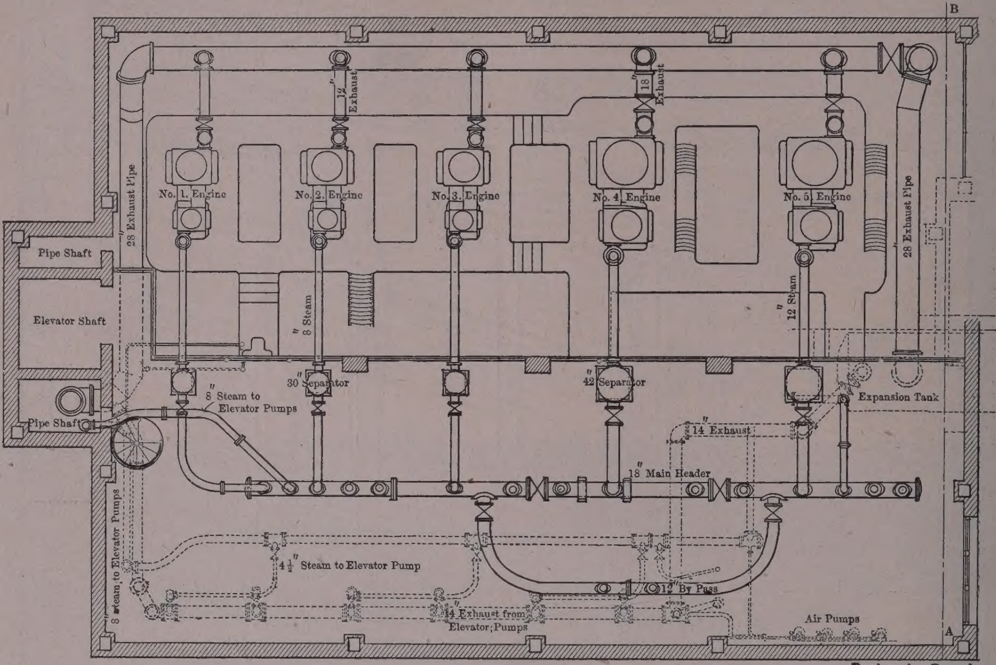
Coal and Ash Bins.—The coal-storage provisions consist of a 650-ton bin on the floor above the boilers and a bucket-conveyor coal-handling system which involves interesting features. The coal bin is of steel-plate construction, and is 61 ft. long, 28½ ft. wide and 12 ft. high above the floor. The sides are of ⅜-in. steel plate, while its floor is a 4½-in. continuous slab of reinforced concrete. Four pyramidal steel-plate hoppers are set in the floor on the center line of the bin in order to form the delivery outlets to which the down spouts are connected. The bin has a flat bottom to the sides of the outlet hoppers, which makes it necessary to shovel out the last of the coal if it is desired to empty the bin entirely, but the fact that the latter contingency will seldom prove necessary and the cheapness and greater capacity of the flat floor made a sloping floor construction appear inadvisable. The coal conveyor is carried over the top of the bin with a 3-ft. walk on either side.

Adjacent to the coal bin at the front end of the building there is a 75-ton ash pocket for temporary storage which has a construction similar to the coal bin. This bin is 9x22½ ft. in plan, with sides of ⅜-in. steel plate, 12 ft. high. It has a single pyramidal hopper outlet, set into the floor, which connects with an outlet delivery chute extending downward inside the front wall of the building to a trimming spout at the street level for loading into ash wagons. As this floor also contains the equipment of machinery for the induced draft, both bins are covered with a hood, which leads to a ventilator, for the purpose of carrying off the dust that would otherwise be communicated to the room.

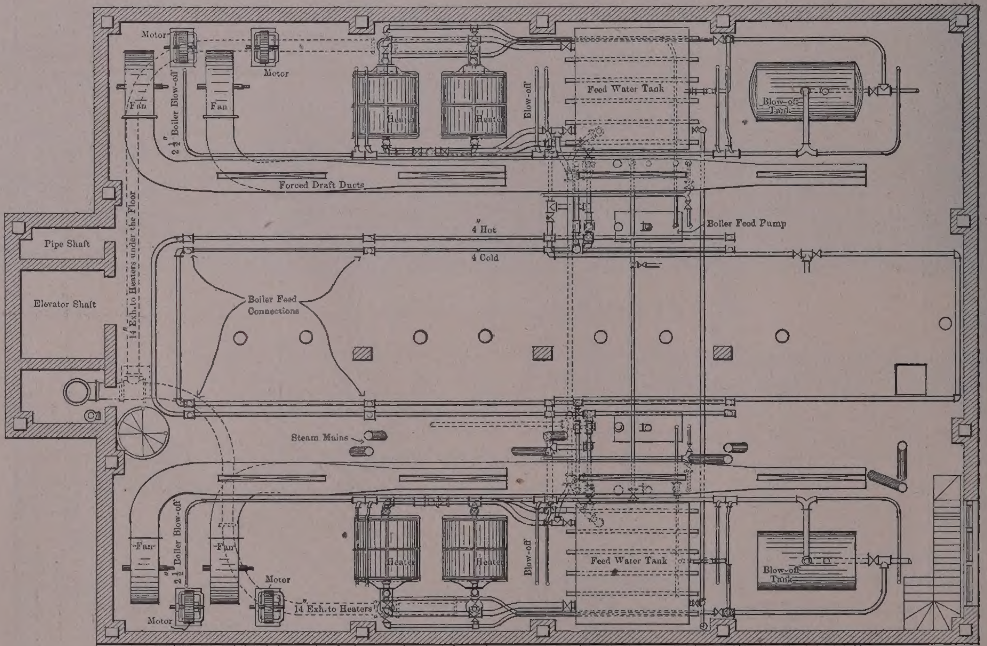
Coal and Ash Handling.—A very complete coal and ash-handling system has been installed, which obviates all manual work. It is of the Dodge type of bucket conveyor and encircles the boiler room and coal and ash bins, passing down the front of the building to a coal-receiving pocket into which the coal is dumped directly from the delivery wagons. This receiving pocket is located in a vault and consists of two bins under sidewalk coal holes, which feed into the lowest horizontal run of the conveyor through a reciprocating feeder, designed to deliver automatically and uniformly to the buckets. The latter are of a new non-overlapping, pivoted type, swung between two strands of steel strap chain, supported and guided by flanged rollers traveling on T-rails.

The noteworthy feature of the construction is the means provided to prevent the escape of material between the buckets. While clearance between the buckets is absolutely necessary for practical operation, care must be taken to prevent the accumulation of the material which falls through and under the conveyor, as the inevitable tendency of all such obstructions is trouble, if not damage to the conveyor. To avoid the difficulty the Dodge conveyor has been fitted with what may be called gap buckets, rigidly suspended from the side bars of the chains and extending between and underneath the separations of the conveyor buckets. As the coal falls between these buckets at the time of loading the gap buckets intercept and hold the leakage. When the conveyor makes its turn from horizontal to vertical, as shown in the illustration, the gap buckets assume a position at right angles to the attached chain links, and each discharges its contents into the pivoted bucket that follows directly after. This provision entirely obviates the necessity of added appliances to enable them to pass each other without interference, and the introduction of special loading devices.

The flexibility of the Dodge conveyor is apparent from the positions shown in the longitudinal section diagram. A short horizontal run following the loading precedes the first ascent of 56 ft. to the auxiliary, or ashes, floor below the boiler room, over which the conveyor travels about 75 ft. to the north side of the building for its final ascent to the discharge track over the coal bunker. The distance from the auxiliary floor to the top of coal bunker is about 60 ft. By means of a movable dumper operated by a wire rope coiled on a drum by a hand crank, the loaded buckets are consecutively tripped and emptied at any point in the bins desired. The greatest vertical height of the machine is 118 ft., and the longest horizontal run, over the coal bunker and ashes bin, 79 ft. Turns are made over chilled sprocket wheels, those at the foot, shown to the right of hopper under sidewalk, being fitted with a take-up device.



General Plan of Engine Room and Mezzanine Piping, Wanamaker Power House.

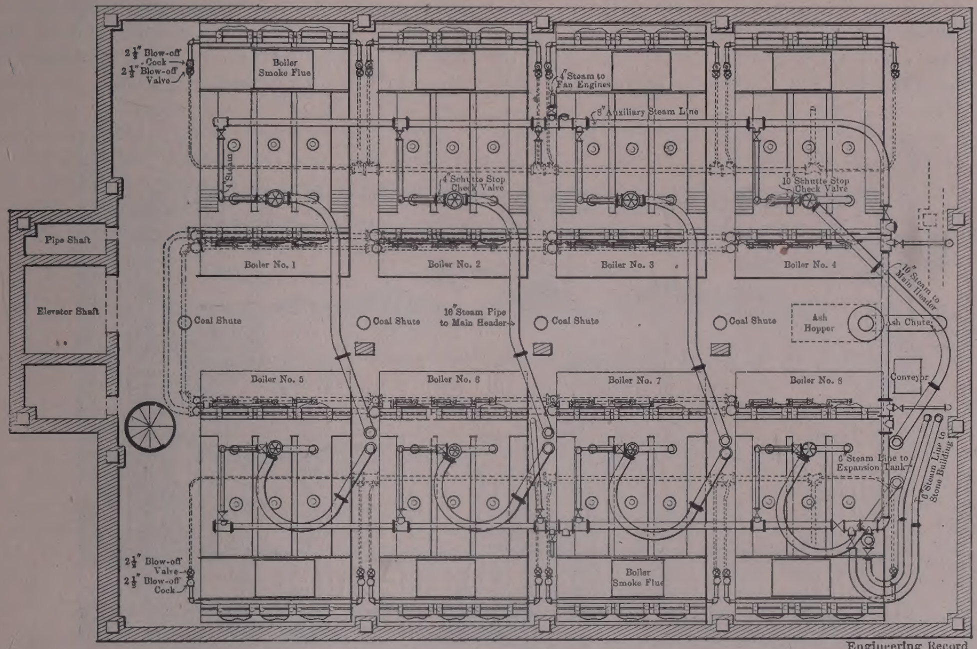


Steam Piping, Auxiliary Boiler Floor, Wanamaker Power House.

Equalizing gears, driven by a size 35, 25-h.p. fully-enclosed form I Crocker-Wheeler motor, impart a smooth and uniform traveling speed to the conveyor, which is surrounded in its ascending and descending runs by steel casings. The drive is designed to impart a speed to the conveyor of 45 ft. a minute. Its capacity is 45 tons an hour; individually the buckets are capable of a capacity of 110 lb. a foot, but at the present speed only 60 lb. a foot need be handled to give the hourly capacity indicated. This conveyor system was designed and built by the Link-Belt Engineering Co., Philadelphia, Pa.

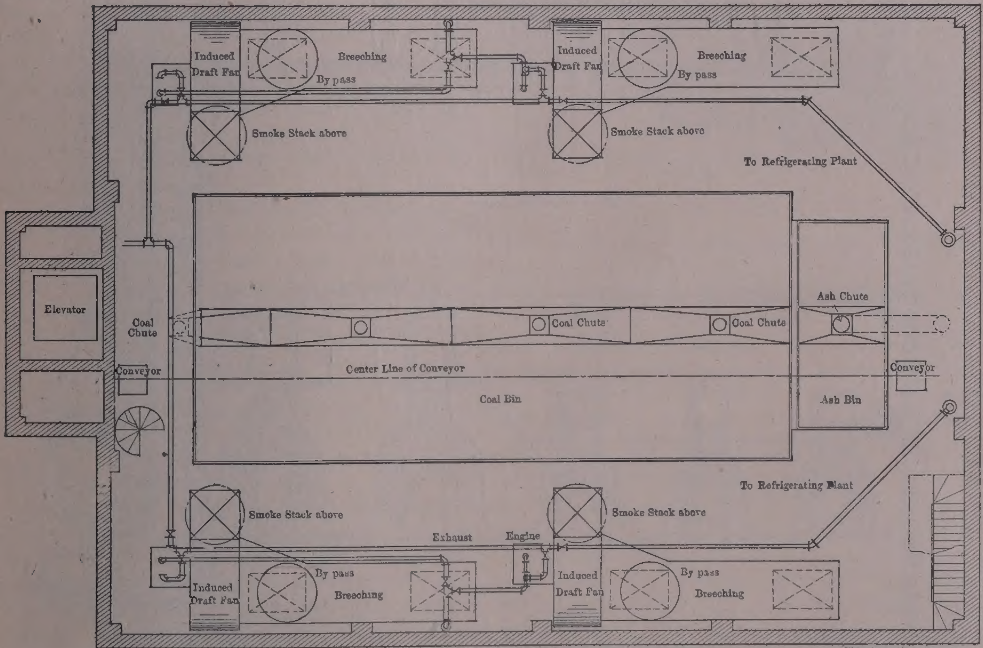
Coal is delivered from the storage bunkers through swinging spouts to the boiler room floor below. These spouts are flared at their upper ends to surround under-cut gates fitted to the hoppered bottoms of the bunker, which gates are operated by hand chains fastened to both ends of the gate levers. Ashes are raked from beneath the fires into floor hoppers located midway between the two lines of boiler fronts, and chain-operated rack and pinion gates control the flow through spouts to the conveyor buckets. The ashes storage bin is hopper-bottomed, fitted with an under-cut gate operated in the same way as the coal gates. The steel spout which extends from this hopper down and through the building ends in a rack and pinion gate at the street level by which the ashes are discharged into carts for removal.

Draft.—Both forced and induced draft has been provided for both on account of lack of available space for tall stacks and in order to secure the most complete control of the boilers. There are four blowers for the forced draft located on the boiler auxiliary floor below the boilers, each of which is a 110-in., full-housed, steel-plate fan having a capacity at 385 r.p.m. of 27,000 cu. ft. of air against a total pressure of 1¼ oz. The design was based on a temperature of 80° Fahr. for the incoming air. The fans have horizontal discharge outlets 38 in. square, which connect with the furnace delivery ducts carried forward on the ceiling of this room directly below the boiler furnaces, so that short, direct connections to the outlets in the bridge walls are possible. Their outlets are controlled by levers at the boiler fronts connecting with valves in the branches so that any desired amount of blast can be obtained. Each of the four blowers is driven through a silent chain drive by a 40-h.p. Crocker-Wheeler motor with considerable overload capacity. The blowers have fan wheels 66 in. in diameter and 26 in. wide, and require 25 h.p. for operation at the normal speed of 385 r.p.m. and 40 h.p. for operation at 443 r.p.m.



Engineering Record

General Plan of Boiler Room and Piping, Wanamaker Power Plant.



Engineering Record

Coal Storage Room Plan, Wanamaker Power House, Philadelphia.

The induced draft equipment has four 180-in., full-housed, steel-plate fans of the top discharge type, having special features of design in order to handle the hot gases of combustion from the boilers. They are designed for a capacity of 51,000 cu. ft. of gases per minute at temperatures in the vicinity of 555° Fahr., and develop a draft of 1½ in. of water at 250 r.p.m. or 2 in. at 288 r.p.m. There is one fan for each two boilers. One is located directly over the union of the breechings at the rear of each pair of boilers, from which it discharges directly into a short stack of steel plate construction extending through the roof. The fans are by-passed for a discharge of the gases directly into the stacks if it is desired to operate without induced draft. Each induced draft fan is driven by a 50-h.p. simple horizontal center-crank enclosed steam engine, supplied with steam from an auxiliary header in the boiler room below. These engines have heavy frames and extended bases for carrying outboard bearings supporting the overhung fan wheels. Each engine is carried on a special sheet steel pedestal built integral with the fan housing to afford a rigid attachment with the engine frame. Each engine has 10x10-in. cylinders and is required to develop 32 h.p. to run the fan at 250 r.p.m. and 51 h.p. to run it at 288 r.p.m. The entire equipment of forced and induced draft fans was supplied by George E. Dixon & Co., Chicago.

Auxiliaries.—The boilers are fed by four duplex feed pumps located on the floor below, there being two ring feed mains of 4-in. pipe, one for cold and the other for hot water, with independent 3-in. branches to each boiler. The pumps are 14x8½x12-in., brass-fitted, outside-end-packed plunger feed pumps of the pot valve pattern and were built by the Knowles Steam Pump Co. Their supply and delivery connections are flexibly arranged so that any delivery combination desired may be secured, such as hot or cold feed water through either line and from any pump, although it will be normally so arranged that the hot feed will always be delivered through the outside main and the other or cold feed line will be held always ready in reserve for immediate use in case of accident to the feed-water heaters or other portion of the hot feed-water system. The main feed supply is maintained in two 6,500-gal. tanks which are suspended beneath the boiler room floor on special platforms with solid beam and concrete floors, which clear the boiler auxiliary floor by about 7 ft. These are filled from the drips, condensation returned from heating system, etc., make-up being taken from the city water system.

There are four open feed-water heaters in use for the heating of the boiler feed with exhaust steam. These are of the horizontal cylindrical type of the Webster class ED vacuum feed-water heater, purifier and receiver, and each is rated nominally at 1,500 h.p., with a capacity for heating 69,000 lb. of water per hour, or a total of 276,000 lb. per hour for the four heaters, from an initial temperature of 45° to a final temperature of 210° Fahr. To heat this amount of water 10,066 lb. of exhaust steam are required per hour for each heater, which, in condensing, reduces the quantity of feed water to be pumped by just that amount. The Webster vacuum line attachment prevents the heater from becoming air-bound, and also, when the supply of exhaust steam is insufficient to maintain atmospheric pressure within the heater, a partial vacuum will result in the exhaust pipes connecting the heaters and engines, the degree of vacuum depending on the temperature of the feed water and the height of the water level in the heater above the level of the pump suction valves. The heater is equipped with an oil separator in the exhaust steam inlet which prevents contamination of the feed water with oil from the engine and pump cylinders.

The exhaust steam connections to the heaters are made under the floor by a 14-in. connection from the atmospheric riser of the exhaust system in the pipe shaft at the rear of the building, adjacent to the elevator shaft. This riser is a 28-in. pipe leading from the engines and pumps to a relief valve near the roof and connects in the basement with the heating mains leading to the store, so that steam is taken inductively from the system as required. The feed pump exhausts are led directly to the heaters, into which they deliver at all times. The cold water supply to the heaters is made through a 6-in. connection from the suspended tanks on the same floor, and there is also a connection from the return tanks in the basement through which the hot condensation from the heating system is raised by two submerged centrifugal pumps, each of a capacity of 200 gal. per minute.

Piping.—This floor also contains the blow-off piping systems, which consist of two 2½-in. blow-off connections leading down from the rear of each boiler and delivering to a 6-in. blow-off main on either side of the building which ends in a 6x12-ft. cylindrical blow-off tank. Both of the blow-off tanks have 6-in. outlet connections to the sewer and 3-in. vapor connections to the atmosphere. The feed-water tanks suspended from the ceiling are 12½x11½x6 ft. in size, and each has a capacity of 6,452 gal. of water, the platforms carrying them each having a capacity of 22,000 lb. Cold water is supplied to these tanks by two centrifugal pumps in the basement, each of a capacity of 220 gal. per minute.

The piping systems in this plant are of more than ordinary interest on account of the contracted spaces surrounding the apparatus and the arrangement of the latter in tiers. The high-pressure steam piping, and particularly the steam header arrangement on the second mezzanine floor, has a remarkably novel arrangement which has many features to commend it for use in the contracted spaces imposed by conditions in large cities. The general arrangements of the various systems of piping are illustrated in the various floor plans of the power house.

The nucleus of the high-pressure system is the 18-in. main header located on the second mezzanine floor, into which the boilers deliver from above and from which the engine branches are taken off at the front side. The second mezzanine floor is elevated only slightly above the level of the engine cylinders and opens outward toward the engine room, so that the engine branches are made without the difficulty of passing through a partition wall. The boiler connections are carried down from the stop check valves through 10-in. branches with easy bends, passing between the boilers and through the boiler auxiliary floor below, direct to the header. Each boiler delivers through a 10-in. Schutte stop check valve, which prevents return of steam to any boiler without pressure, and to this is connected the long-radius bend. The 18-in. header is of wrought steel, with flanged cast-steel nozzles on the upper side for the branch connections, and is divided by stop valves into three sections for subdivision of the equipment if desired. The middle section cares for two of the boilers and the outside section for three boilers each, the latter being connected by a 12-in. by-pass at the rear, which gives all the advantages of a ring main in flexibility of arrangement.

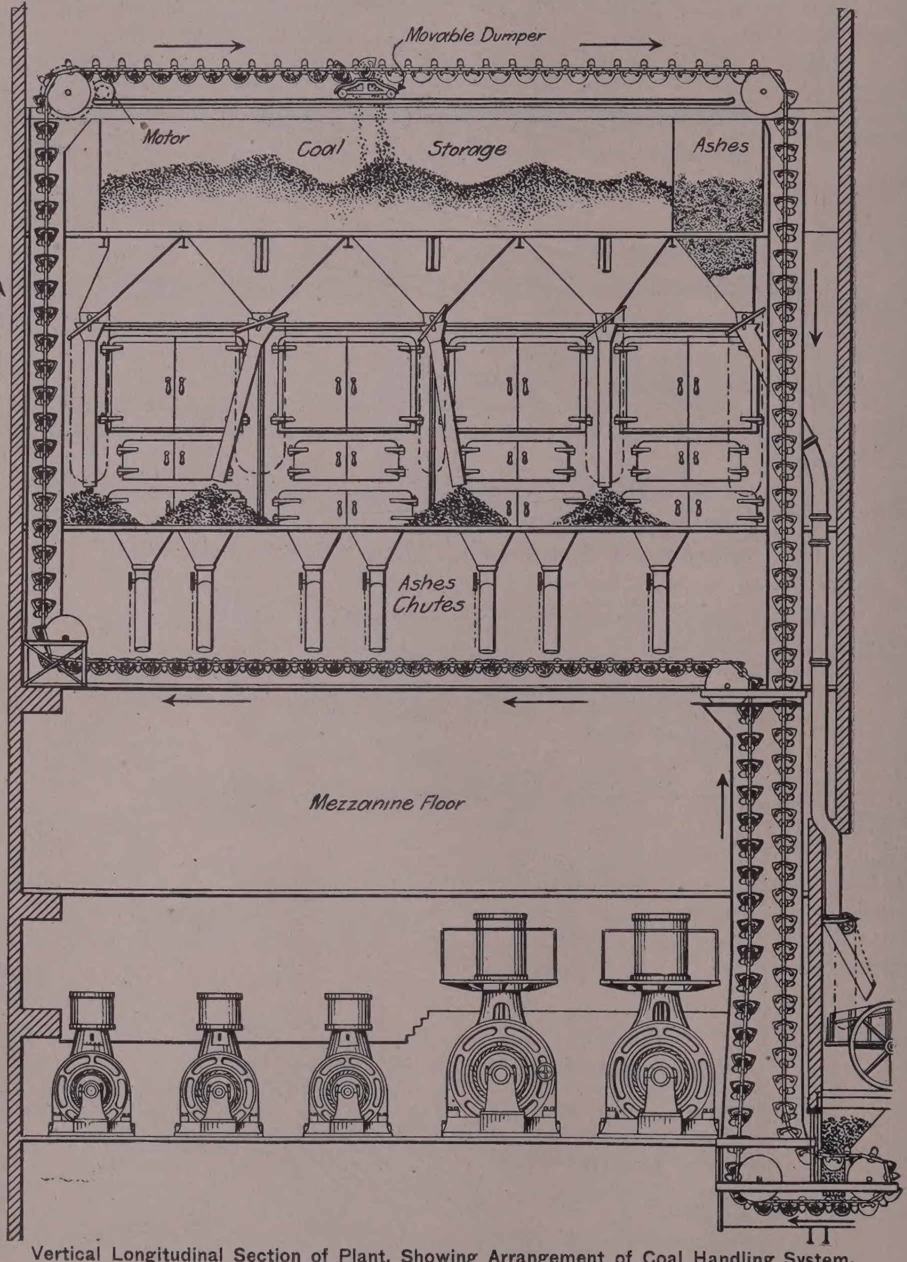
The engine branches are of 12-in. pipe for the two larger units and 8-in. for three smaller, and lead to the engine through vertical steam separators, designed by W. K. Mitchell & Co., which are 42 in. in size for the larger units and 30 in. for the smaller. In addition to these two 8-in. branches are carried, one from each end of the header, down to an auxiliary 8-in. pump room header, from which the various pumps for elevator and other services are operated. There is also an 8-in. auxiliary steam header located in the boiler room above the boilers which supplies steam to the boiler feed pumps, to the induced-draft fan engines and the refrigerating machinery on floors above. This auxiliary header has a 4-in. connection to each boiler through a 4-in. Schutte stop check valve, and has 4-in. branches to the feed pumps and fan engines, two 3-in. branches to the refrigerating machinery, a 6-in. connection to the exhaust heating system for adding live steam in case the supply of exhaust is insufficient, and an 8-in. auxiliary live steam lead which is carried over through the tunnel to the store building.

The entire piping equipment of the power plant is the work of W. K. Mitchell & Co., Philadelphia, Pa. The Mitchell recessed lap joint was used for all joints in the piping, all those for the high-pressure systems using rolled steel flanges. This joint is made by flanging outward the end of the pipe to within ¼ in. of the bolt holes, and setting it into the recess in the face of the flange. The lap when finished projects above the face of the flange about 1/32 in. Chapman valves have been used throughout in this installation.

Engines.—The engine equipment consists of five units direct-connected to generators, two of which are of 1,600 i.h.p. and three of 575 i.h.p. capacity. The two larger units are vertical cross-compound, non-condensing engines, each having a high-pressure cylinder 30 in. in diameter and a low-pressure cylinder 52 in. in diameter, both with 36-in. stroke. Each of these engines is designed to operate two 500-kw., direct-current Crocker-Wheeler generators, one on each end of the main crank shaft, at a speed of 115 r.p.m. Each of these engines will develop approximately 1,600 i.h.p. at 140 lb. initial steam pressure and the most economical point of cut-off, and a maximum of about 2,200 i.h.p.

The three smaller units are vertical cross-compound, non-condensing engines, each having a high-pressure cylinder 18 in. in diameter and a low-pressure cylinder 30 in. in diameter, both with 30-in. stroke. Each of these is designed to operate two 175-kw., direct-current Crocker-Wheeler generators, one on each end of main crank shaft, at a speed of 150 r.p.m. Under 140 lb. initial steam pressure, these engines will develop approximately 575 i.h.p. at the most economical point of cut-off, and a maximum of about 800 i.h.p.

Each engine is of the Porter-Allen type, the cylinders having four valves, two for admission and two for exhaust, and the high-pressure admission valves are controlled automatically by a Porter governor. Each engine is provided with a heavy fly-wheel, the crank shaft being divided in the middle where the fly-wheel is placed, and each half having forged solid with it a double-throw crank, properly counterbalanced. Each engine is provided with a cast-iron sub-base extending under the engine bed and supporting the generators and outboard pedestals. All of the engines were built by the Southwark Foundry & Machine Co., Philadelphia.



Vertical Longitudinal Section of Plant, Showing Arrangement of Coal Handling System.

Electric Equipment.—The electrical generating equipment consists of four 500-kw. and six 175-kw. standard Crocker-Wheeler generators, which are driven in pairs by the steam engines above referred to. The generators have an improved magnet frame with internal flanges, which insure ample stiffness and give a finished appearance to the machine. The frames are split horizontally and the poles are round, of steel, cast-welded in the frame so as to make a perfect magnetic joint. Each pole is fitted with a cast-iron removable shoe which serves to produce the best distribution of the magnetic flux over the armature surface, and also serves to retain the field coils in position. The air-gap between the armature and pole face is large, which tends to reduce the bad effects produced by any slight displacement of the armature. The field coils are wrapped with heavy tape and heavily impregnated for the purpose f protection from mechanical injury as well as moisture, and the form of construction involved provides free air circulation for cooling. The brackets which carry each set of brush-holders are individually adjusted, a feature of the Crocker-Wheeler machines, by which a balance can be secured between the electrical circuits composing the windings without resorting to special compensating devices in the armature. The machines are operated on the Edison three-wire system with the lights on the 115-volt circuit, and the power taken from the 230-volt combination.

The electrical circuits are controlled from a switchboard in the first mezzanine gallery, from which all movements in the engine room are readily observed. This switchboard, which was, together with all the power house and store wiring, installed by J. F. Buchanan & Co., of Philadelphia, has ten generator panels, two totalizing panels and several feeder panels for the main feeders leading to the distributing switchboards in the store building. All circuits are carried over to the store in the tunnel.

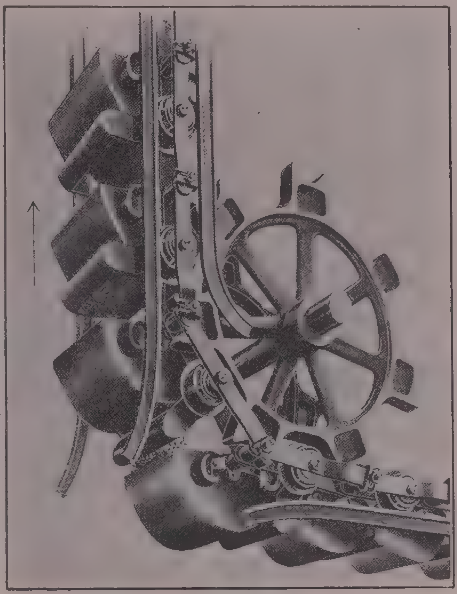
Pumps.—The equipment of the pump room includes a variety of pumps for different classes of service at the power plant and at the store. The largest are those devoted to the elevator service, which is to be extensively provided in the new store. There are to be in all 52 passenger elevators, 10 freight elevators and 7 sidewalk lifts, all of which are being installed by the Standard Plunger Elevator Co., New York. The pumps for their operation are also being installed by this company in the power plant and include four pumps designed for a working pressure of 150 lb. and one for 250 lb. The latter is a special pump for use in the lifting of safes and other very heavy objects on the freight elevators. It is a compound duplex pump of the outside-packed plunger type, with 12x18½x9x18-in. cylinders, and at an operating steam pressure of 150 lb. has a capacity of 400 gal. per minute against the delivery pressure of 250 lb.

Two of the pumps are of the three-cylinder, high-duty crank and fly-wheel Corliss type and two of the compound duplex type. The former have 17¾x22x22x12¾x30-in. cylinders and a capacity at 46 r.p.m. of 2,250 gal. per min.; these units have forked frames with crank fly-wheels and are single-acting. The compound duplex pumps have 16x25x15x18-in. cylinders and a capacity of 1,100 gal. per min. All four have outside-center-packed plungers, and are designed for operation with 150 lb. steam pressure and against the delivery pressure of 150 lb.

Among the remaining equipment of this room there are two 6x4x6-in. duplex pot-valve pattern brass-fitted Knowles pumps of the outside end-packed plunger type, with receivers for the high-pressure drip system. There are three 7x8-in. vertical single-acting triplex brass-fitted Deane pumps which are used for delivering water to the house tanks supplying water for plumbing fixtures, etc.; these are driven by Crocker-Wheeler motors and, operating at 50 r.p.m., will each have a capacity of 10,000 gal. per hour. Two centrifugal pumps similar to those lifting water for boiler feed purposes furnish water from an artesian well in the basement to the refrigerating plant on the top floor. Two bilge pumps of 100 gal. capacity per minute each will deliver all drainage from the mechanical plant to the sewer. Two 6x6-in. Clayton air compressors, each driven by a 7½-h.p. Crocker-Wheeler motor, will supply compressed air for all purposes.

The heating system of the store is supplied with exhaust steam from the general exhaust system at the power plant. All engines and pumps, with the exception of the boiler feed pumps, deliver into an exhaust header of 28-in. pipe which leads up at the rear of the building to the atmospheric exhaust outlet at the roof and downward into the basement into an 8x30-ft. expansion tank from which the heating mains are taken. Of these there are two of 16-in. pipe and two of 18-in., which lead out through the tunnel to the store. All low-pressure piping is also fitted with the Mitchell recessed lap joints, with light steel flanges for entire reliability.

The refrigerating plant to be installed on the top floor will be of the absorption type, with steam-supplied generators, condensers, absorbers, etc., the details of which have not as yet been determined. A novel feature will be the pumping of brine to the cold-storage fur vaults on the top floor of the store building and also to the various refrigerators for the grocery department, cafe, etc. For this there will be required a complete system of brine circulating pipes, pumps, etc. It is also intended to provide additional equipment for the freezing of can ice.



Detail View of Coal Conveyor.

The power plant building was designed and its construction supervised by D. H. Burnham & Co., architects, of Chicago. The design of the mechanical features was directly in charge of the late C. M. Wilkes, to whom much credit is due for securing a practical and economical layout in the contracted space conditions governing the entire power installation of this plant.

The Simplon Tunnel Surveys under Prof. Rosenmund, of Zurich, had some remarkable features. The leveling presented few difficulties, and when the headings met the elevations were only 0.1 m. out. No attempt was made to secure great accuracy in the length, but this measurement was out only 1/10,000. The greatest trouble was in alignment, but the work was done so well that no variation could be detected in the lines carried forward from the two portals. The conditions of the work, according to "Engineering," make this result astonishing. The moisture in the tunnel often formed clouds, so that the instrument man could not see distinctly, and sometimes there was a sort of mirage giving two equally distinct images of the lamp in the telescope, neither of which would probably give the true line. The attraction of the mountain for the plump-bob caused a displacement of the latter at some stations producing an error of 24 seconds of arc.

Reinforcing the Poughkeepsie Bridge.

The famous bridge across the Hudson River at Poughkeepsie is a high-level, double-track deck structure, 6,747 ft. in total length, which was completed nearly 20 years ago. The five main spans are symmetrical about the center point, near the middle of the river, and consist of two 525-ft. intermediate anchor spans, two 548-ft. and one 546-ft. cantilever spans, and two 201-ft. shore anchor spans. The pin-connected trusses are 30 ft. apart, c. c., and are from 37½ to 75 ft. deep. They are seated on steel river towers approximately 100 ft. high on stone piers, with foundations carried down in cribs sunk by dredging to a great depth. The base of rail is at an elevation of 212 ft. above the water. The 2,640-ft. east approach viaduct has one 175-ft., one 162-ft. and three 115-ft. and 116-ft. pin-connected truss spans and nineteen lattice girder spans of from 60 to 85 ft. The 1,033-ft. west approach has two 145-ft. pin-connected truss spans and eight 53 to 60-ft. lattice girder spans. The main river spans have two trusses, each with steel floor beams and stringers. The approach spans have wooden floors supported on the top chords of three lines of trusses and girders, the center line being supported on transverse Fink trusses and the side lines on the caps of the steel trestle columns.

At the site the banks are very high, and the water in the river is about 60 ft. deep, with a bottom of soft mud extending to a great depth. These conditions made the construction of the river piers and the erection of the river spans very difficult and expensive, and the most interesting features of the work were described in a series of articles published in The Engineering Record about the time of the completion of the bridge. The falsework for the intermediate anchor spans was very heavy and expensive, and has been considered one of the handsomest pieces of such work that has ever been built; the framed bents were seated on pile bents made with piles 120 ft. long, composed of two pieces butt-spliced with long wooden side pieces bolted on.

The bridge was designed to carry on each track a train load of 3,000 lb. per lin. ft., headed by two coupled locomotives, each having four 24,000-lb. axle loads. All members were proportioned for unit stresses from dead and live loads, and had additional section for all computed stresses due to wind pressure on a liberal estimate of surface, so that ample provision was made for lateral stresses. During the time that the bridge was controlled by the Philadelphia & Reading Railway it was used by much heavier locomotives run at high speeds, and causing undue severity in the stresses. Since that time the heavy locomotives have not been used on it, and the speed of trains has been reduced to six miles an hour.

The bridge is owned by the Central New England Railway Co., leased by the New York, New Haven & Hartford R. R. Co. It forms a link in the system, which is being developed for heavy service, and in order to secure a much greater capacity than it was originally designed for, it has been decided to reinforce it so that it will have uniform strength with the other structures on the line and will conform to the requirements of the specifications of, on each track, a train load of 3,600 lb. per lin. ft. and two locomotives, not coupled, each with 45,000 lb. on each of four driver axles 5 ft. apart, or 200,000 lb. on a 22½-ft. wheel base, and 28,000 lb. on each of four tender axles, 5 ft. apart.

The improvement is in accordance with the requirements of the railroad company. Mr. F. S. Curtis is second vice-president, Mr. E. H. McHenry fourth vice-president, Mr. Mace Moulton, consulting engineer, New York, has been given full control of its design and execution.

A very minute and thorough examination showed that the foundations are excellent and ample for the increased loading, that most of the masonry sub-structure is of excellent quality and in good condition, and that the superstructure was well designed and is in good condition, and that it does not need reinforcement against wind stresses. Five complete plans with careful estimates were made by Mr. Moulton for different methods of reinforcing or strengthening the superstructure for the increased loads and heavier service required. Some of them involved the use of a comparatively small quantity of steel and a large amount of difficult labor in reinforcing the members of the old trusses; others required more steel and less labor; some required the use of expensive falsework. Competitive bids were received on the design finally selected, and the contract was awarded for $1,300,000 to the American Bridge Co., the work to be completed in 1906 without cessation or serious interruption of traffic.

The five main spans will each be supplemented by a new center truss of the same general design as the old ones, and proportioned to carry all the loads that the old trusses are not efficient for. The alignment of the tracks will be shifted so as to distribute the loads in accordance with this arrangement, which will allow approximately half the loads for the new trusses. The new trusses will be supported on new V-shaped or Y-shaped bents in the planes of the old steel towers, and will thus materially improve the condition of loading on the rather slender river piers. These are now loaded at three points, at the center and at both ends, where the four batter posts comprising the present bents are seated. The new arrangement will have footings midway between the old pedestals for the two new inclined posts, which will intersect the old ones, and will at the same time relieve the old pedestals of part of their loads and apply the new loads on a part of the masonry not previously directly loaded.

During the erection of the new portions of the superstructure trains will be run on only one of the tracks, and the stresses in the old structure will not be increased above their present maximum. The two 525-ft. trusses will be supported during erection from the trusses of the old spans, which it happens have a larger reserve of strength than the other long trusses, and are, therefore, best able to sustain the increased loads. The 201-ft. shore trusses will be erected on the falsework provided in connection with the reinforcement of the anchorages, and the 546-ft. and 548-ft. spans will be erected without falsework by the cantilever method, with very little support from the old structure, utilizing the new trusses previously erected for the reactions. All the new trusses will conform very closely in general appearance to the old trusses.

The upward reactions at the ends of the 201-ft. shore spans are resisted by the weight of the masonry piers supporting their shore ends, and the weights here provided have been less for the severe service which they have been subjected to than would be provided by the designers of today. Some indications of overstraining have been detected by a very careful examination of the masonry, and a large increase of stability will be secured by adding vertical eyebars to the old anchor chains, adding reaction girders bearing under the existing beams and projecting beyond the faces of the present piers, and by building entirely new anchor chains and reaction girders between and outside of the old ones for the new trusses. The outer faces of the piers will then be enclosed with a shell of concrete considerably increasing the size and weight of the piers.

The longest spans in the approaches are naturally over the lowest ground, and their height is so great that falsework for the erection of reinforced spans would be very costly; therefore, it has been decided to strengthen them by providing one new truss for each span. This will be erected to act with one of the present trusses, and carry one track service while one old truss is repaired at the bridge shop. When it is repaired it will be erected and the new truss shifted over to replace a second old truss while it also is taken to the shops and reinforced. When the second old truss is replaced in the bridge the third old truss will be discarded and the span will consist of one new truss on the center line and two reinforced old trusses on the outside lines. In the short spans the lattice girders will all be replaced by plate girders supported on the present trestle bents, and the center line of girders will be supported on single vertical columns which will replace the old Fink trusses.

The pier on the west bank of the river is terraced into the shale rock so that the shore side was built in contact with the rock for its full height of 40 ft. The base of the pier is narrow, and the stratification of the rock is very irregular, with the dip varying almost from horizontal to vertical. The pier was not sufficiently bonded or anchored to the rock, and under the very severe service of the Reading traffic and the action of frost and other causes it has shown indications of threatened displacement. To prevent this it will be anchored back to the rock by a large number of 2-in. horizontal wedge-bolts 8 ft. in the rock, which will have nuts bearing on distributing channels on the face of the masonry. Some new piers will be built for the feet of the new vertical posts in the viaducts, and the upper courses of the main piers will be partly removed to secure satisfactory concrete beds for the new trestle bents. Some changes may also be found desirable for the shafts of the main piers, but if executed this work will be separate from the general contract.

The principal designs have been completed, and work will soon be commenced on the reinforcement of the anchor piers, which it is hoped may be completed this year. The work will be commenced on the truss spans and approach superstructure early next spring. The estimated weight of the new steelwork is over 15,000 tons.

A Concrete Building in Liverpool.

The disposal of the clinker from refuse destructors in Liverpool has been a problem of considerable difficulty for many years. Nine years ago, when Mr. H. Percy Boulnois was city engineer, he used this material as the aggregate for concrete for lintels, window sills, door-steps and similar parts of dwellings of low cost, but recently his successor, Mr. J. A. Brodie, has used the material in a reinforced concrete tenement house. It has been built to prove that satisfactory dwellings for low rentals can be constructed from what is practically a waste material.

About 50,000 tons of clinker are produced annually at Liverpool, and the cost of disposing of the portions not utilized is about 60 cents per ton. At the present time, Mr. Brodie reports, about 15,000 tons are dumped at sea at an even higher cost. The portion of the clinker for which a use is found is mainly crushed for the aggregate in concrete sidewalk slabs, of which 160,000 sq. yd. have been laid. Recently it has been used for the foundation of pavements and similar works and in the manufacture of paving blocks for roadways carrying comparatively light traffic. At the best, however, not over a third of the clinker can be put to use by these methods, and accordingly permission was obtained from the Local Government Board two years ago to put up a clinker concrete tenement house, reinforced with a little steel.

The building covers 234 sq. yd. of a plot having 413 sq. yd. It has three stories, each with four tenements. Each tenement has a separate doorway and is self-contained, and the balconies by which the upper tenements are entered are reached by open stairs from the streets. Each tenement has a 15 x 10⅓-ft. living room, two bedrooms averaging 15¼ x 7¾ ft. and 10 ft., a scullery and a toilet. Gas and water are piped into each tenement, and the living room contains a range and a food cupboard ventilated into the outer air. The bedrooms have grates. The roof is flat and fitted up as a playground and for drying clothes.

The construction of the building is wholly unlike anything attempted in the United States. The ceiling, the floor and each of the four sides are separate concrete slabs, weighing 1 to 11 tons and hauled to the site by a traction engine. The openings for doors, windows and fireplaces were made when the slabs were manufactured, and mortices and tenons were left at the edges so that all parts would dovetail together. The joints were made with cement mortar, and two 1-in. bolts were used at each vertical joint to hold the parts together while the joint was setting. The balconies, stairs, parapet walls and chimney tops were molded blocks, and the chimneys and ash chutes were lined with earthenware pipes. Except for a margin around each room, the floors were covered with ¾-in. boards, bedded in a hot pitch mixture and nailed to scantlings set in the concrete.

The slabs were made 14 in. thick, as recommended by the Local Government Board, instead of 7 in. as intended by the city engineer. The thick slabs had to be left six to eight days in the molds before they could be moved safely. Some of them met with an accident, and in order not to incur delay by waiting for fresh slabs to season, about half the floors were built of concrete in place, carried by steel beams. The foundations consisted of concrete piers 12 ft. deep carrying flat arches on which the walls were supported. This construction was necessary because the building was erected on a site where a cellared structure formerly stood.

The building was estimated to cost $6,100 but about $20,000 was actually spent, owing to the unnecessary thickness of the walls, extra depth of foundations, troubles with molds, and needless expense for framing and scaffolds. Mr. Brodie is confident that similar buildings can be constructed at his original estimate which is considerably under the cost of like structures in brick.

From this experience Mr. Brodie is convinced that any size of slab likely to be used for building purposes in Liverpool can be made and erected safely. The largest yet made was 16 x 13 feet. Floor and roof slabs for the building were tested with heavy distributed loads without measurable deflection or appreciable injury, and the strength of the building seems to be beyond question. The method of jointing the slabs by bolts and cement mortar has proved entirely satisfactory. The buildings are particularly appropriate for low-rental homes, because they are fireproof and can be kept clean with a minimum amount of labor. Mr. Brodie points out that in this type of construction, any reduction in cost depends largely on the possibility of repetition of individual slabs without requiring any alteration of the molds.

The Power Required to Compress Air is, under the average conditions, approximately 1½ h.p. for each cubic foot compressed to a pressure of 100 lb.

Breakage in Sewer Pipes.

The definite information concerning the breakage of sewer pipes is very limited. The existence of cracked pipe in a sewer does not materially affect its ability to carry water, except when laid in quicksand. As a rule, it is only when the pipe is so badly broken as to need replacement or the ground water enters the sewer in excessive quantities that definite information concerning breakage is sought. Mr. Alexander Potter, of New York, has lately been making an investigation of this subject, and at a recent meeting of the Sanitary Section of the Boston Society of Civil Engineers he read a paper giving the opinions he has formed as a result of his studies. In his opinion, there is a decided difference in service conditions between pipe laid for drainage and for sewerage. In the former there are no joints, and each length is free to come to a bearing. In sewers, however, owing to the rigid joints, an imperfect bearing under one length may affect those adjacent to it.

In laying pipe through dry sand, loam or clay free from water, he said, no difficulty should be experienced in securing a good foundation, for the bottom of the ditch can usually be cut out to the approximate shape of the pipe, and a natural foundation is thus afforded. In rock cuts and wet ditches, however, this is impossible, and the natural support of the pipe must be replaced by an artificial one, and the problem confronting the engineer is a serious one.

View Showing Cupola House at Corner of Machine Shop, Navy Yard, New Orleans.

It is a safe assumption, Mr. Potter believes, that the presence of ground water in pipe sewer trenches at least doubles the actual cost of sewer construction, if the best work is to be secured. In the endeavor to prevent this increase in cost to his clients, the engineer is tempted to take chances. A common form of foundation in wet trenches consists of well rammed gravel, broken stone or cinders, usually with the addition of underdrains. Concrete is also used quite generally. A proper foundation is also secured in yielding material by using timber under the pipe, either in the form of planking, some form of cradle, blocking or piling.

The usual methods of replacing back filling material around the pipe are not sufficiently thorough, Mr. Potter believes, to insure the larger sizes of pipe from cracking or collapse. It is practically impossible to backfill properly with the material taken from the trench in general, under and around the pipe on the larger sizes where the natural foundation of the pipe has been removed. Ruptured pipe can only be avoided, in his opinion, by filling the space under the pipe and up to one-third of its height with concrete, which can be very lean if the pipes are properly jointed, or by filling up to the top of the pipe with fine sand, flooded to enable the sand to flow entirely under and around the pipe, thus insuring a hard foundation. The use of the sand in this way is only practicable where some jointing material which immediately hardens is used.

In the construction of the Joint Trunk Sewer in New Jersey, recently completed, with 150 miles of sanitary sewers, trunks and laterals in the municipalities interested, exceptional facilities were afforded Mr. Potter to study this question, for over 65 per cent. of all the ditches were dug through drift saturated with water, requiring the disturbance of the natural bed for the pipe. It was observed that if the joints in sewer pipes were properly made a cylinder of indefinite length was produced, and very slight irregularities in the grade or slight settlements in the foundations greatly reduced the power of the pipe to resist cracking, as the pipe is practically inelastic.

In the work under discussion 3-ft. lengths of pipe were used throughout, and to increase the possibility of securing tight joints Mr. Potter adopted the plan of laying many of the sewers in wet trenches with yielding foundations on cradles. The cradle or wooden underdrain, as it might be called, consists of four pieces of 2x4-in. timber, 9 or 12 ft. long, laid flat 6 in. apart. On these were nailed 4x4-in. pieces 1½ ft. apart. The pipe held by wedges nailed in position rested on the 4x4-in. timbers. The space below the pipe acted as a channel to drain the water in the trench to a sump and prevented its rising on the joints. This construction is cheaper than the ordinary form of broken stone or gravel foundation with tile underdrain. A questionable feature of this construction, however, is that it leaves a greater area under the pipe to be backfilled, and in clay or other compressible soils this is objectionable.

On the construction of the larger sewers all the pipe laid one day was inspected before starting work the next day. When the work was about half completed Mr. Potter made a personal examination, and himself crawled bodily through several sections of the 24-in. sewers in deep cuts and other parts where there was a possibility of breakage, and finding some broken pipe, notified the contractor. The contractor, at a loss to explain its existence, attributed the breaks, which were not many, to the use of the timber supports, and requested permission to use the old form of tile underdrain and broken stone or gravel foundation on the work from that time. This permission was granted. The contractor, desirous of throwing the responsibility of the former breaks upon the method of pipe laying previously used, took more than ordinary care with the work as it then proceeded, including the jointing of the pipe with cement. The joints were in consequence practically perfect, but the ditch was not refilled until the joints had had 24 hours' set. The gravel was then thoroughly rammed under and well up around the pipes. In fact, no more perfect work could have been performed. The depth of the trench at this point ran from 6 to 8 ft., and standard thickness of pipe was being used. When 200 ft. of this work had been laid and the backfilling completed, an examination of it was made and it was found to be broken almost from end to end and actually collapsed at two points.

A systematic inspection of all completed sections was then started and all cracked pipe either replaced or surrounded with concrete. On all sewers 20 in. in diameter and over an assistant engineer crawled through every length of pipe laid. On sewers of smaller diameter an examination was made with the aid of mirrors.

On 26,303 ft. of 24-in. pipe, most of which was standard thickness, 24 different breaks occurred, aggregating 1,500 ft., each break running from 15 to 150 ft. Nearly all occurred either in gravel or rock cuttings. No breaks were found in quicksand. The proportion of breakage on gravel or broken stone foundation with underdrain to the total length of sewer laid with this class of foundation was much greater than the proportion of breakage on timber foundation to the total length of sewer laid on this latter class of foundation. The depths of cuts where breaks occurred varied from 6 to 20 ft., but more broken pipes were found at the lesser depths.

On 8,197 ft. of 22-in. standard pipe at depths varying from 6 to 20 ft., much of which was laid on timber foundation and none on gravel or broken stone, not a single cracked pipe was found.

Fourteen breaks occurred on 4,382 ft. of 20-in. pipe, aggregating 500 ft. in all. All of these breaks occurred in rock cuttings where the pipe was temporarily supported on blocks until selected material was rammed solidly around and under the pipe. A close inspection of the uncovering of the pipe revealed the fact that at certain places sufficient space had not been left at the springing line of the pipe to allow room for the proper ramming of the backfilling around the lower half of the pipe.

On a short stretch of 18-in. pipe laid on a heavy grade the sewer collapsed shortly after construction, due to the flood of water washing out the newly filled-in material over the sewer under the macadam pavement, which dropped on the pipe and ruptured it.

Concreting under all pipe in wet trenches on this work would have added $125,000 to the cost of the sewers, which was $1,680,000 for 145 miles of sewers. The total cost of replacing the broken pipe was less than $5,000. This did not stop all leakage, but the actual amount of leakage on the entire system was less than 15 per cent. of the capacity. Had concrete been generally used and the same care given in jointing the pipe, the leakage could have been reduced fully 50 per cent. The value of the additional capacity thus secured for sewage purposes would have been $148,170. In designing the sewer, provision was made for ground water infiltration of 33 per cent. of the capacity. This is not an unusual allowance.

The lesson drawn by Mr. Potter from this experience and other data which he gave in his paper is that vitrified pipe of 20-in. diameter or larger should not be used in sanitary sewer construction, except on a concrete base, and the relative cost of other construction should be compared on this basis. On sizes smaller than 20 in. he believes concrete should be used under the vitrified pipe far more generally than at present.

An Overhead Track System of a unique character is used at the Niagara Falls plant of the Ramapo Iron Works. The tracks are so arranged that the trolleys running on them can be transferred by means of a traveling crane, which enables the trolleys to command most parts of the buildings, without complicated curves and switches. The crane has the same relation to the tracks that a transfer table in a railway yard bears to the tracks it serves.

The Turbine Pumping Plant of the Buffalo Water Works.

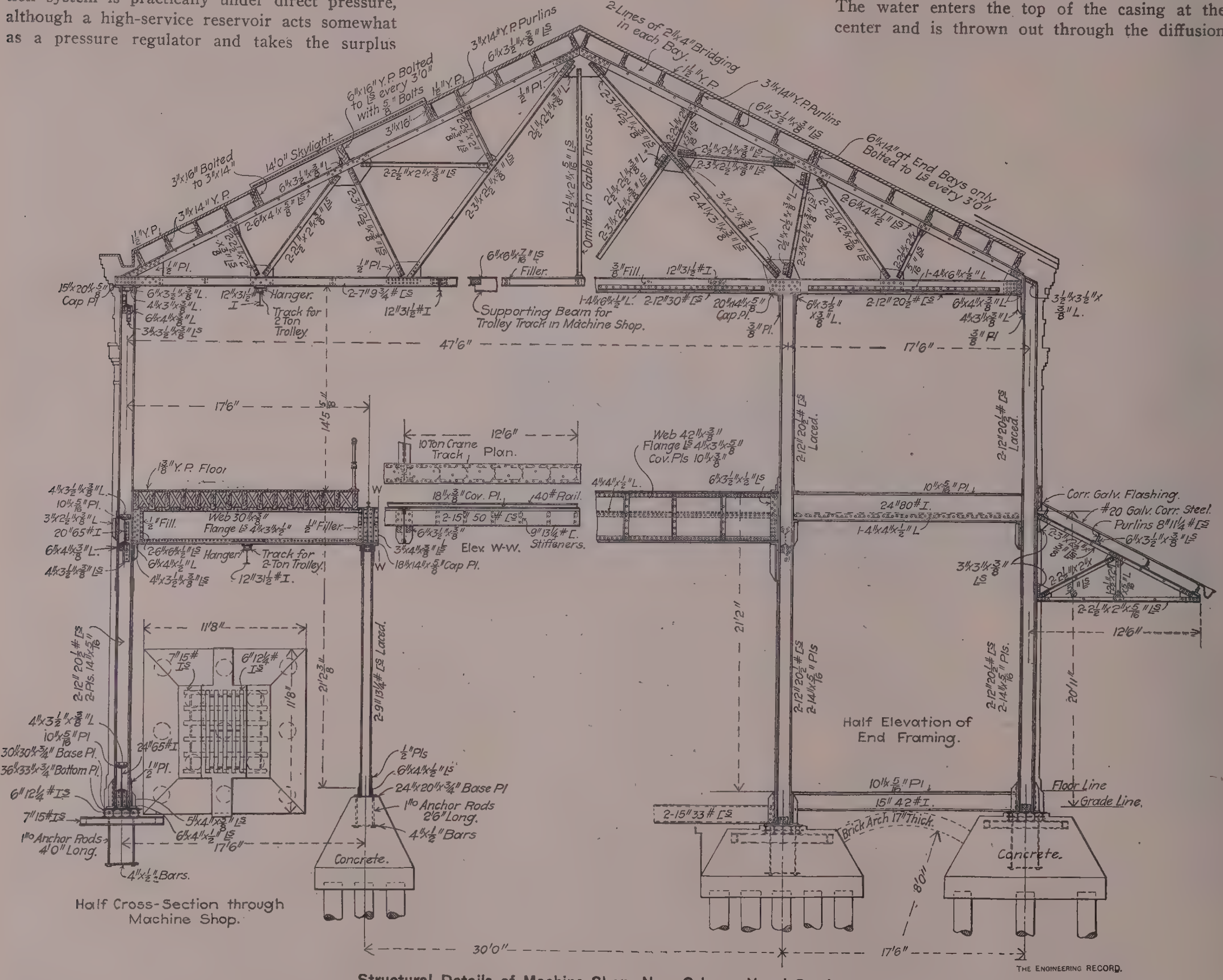
Extensive improvements have been commenced on the water works of Buffalo, N. Y., which will more than double the present pumping capacity when they have been carried out. The distribution system is supplied with water from the Niagara River by a pumping station on the bank of that stream a short distance from its source at the east end of Lake Erie. The contemplated work will involve an expenditure of about $2,000,000, and includes the reconstruction of the existing station, together with the replacement of most of its equipment and the erection of a large new station. The distribution system is practically under direct pressure, although a high-service reservoir acts somewhat as a pressure regulator and takes the surplus water when the demand on the system is decreased. The capacity of the present station before its reconstruction was commenced was about 187,000,000 gal. a day, made up by various types of reciprocating steam pumping engines which had been installed from time to time as the demand for water increased. The average daily consumption in Buffalo is nearly 130,000,000 gal., or 325 gal. per capita, while the maximum consumption is at least equal to the capacity of the old station. Some of the pumping engines were very old types and several of them were too inefficient to warrant their continuation in service. The 34 boilers which furnished steam for the plant were also in poor condition. The station building is an old brick structure built in 1850 and the machinery equipment was very much crowded in it. The building is being torn down in sections, with as little interference with the operation of the pumps as possible, and a new and considerably larger structure erected in its place.

Five 30,000,000-gal. vertical triple-expansion condensing pumping engines are to be installed in the station to replace 7 old horizontal pumping units. Two 30,000,000-gal. vertical triple-expansion pumping engines that were installed in 1896 and 1898 are to be put in good running condition and continued in service. The capacity of the station will thus be increased by the installation of the new pumps and the repairs to those in operation to 210,000,000 gal. a day. The boiler plant is also being reconstructed and partially equipped with new boilers. Five 300-h.p. horizontal tubular boilers have already been installed by Farrar & Trefts, while six of the present boilers of 300 h.p. each are being repaired and altered so they will be adapted to the operation of the new plant.

The new station is to be built on the shore of Lake Erie, about a mile west of the existing station, and will have an intake tunnel extending into the lake. It will have a rated capacity of 200,000,000 gal. a day, and, according to the plans of the Department of Public Works of Buffalo, will contain eight 25,000,000-gal. vertical two-stage turbine pumps. Each of these pumps will be direct-connected to an electric motor, making eight separate units in the station. One of the units intended for this station has been installed in the old station for several months to increase the pumping capacity during alterations and until the new work can be completed and put in service.

The crowded condition of the present pumping equipment, the alterations being made to it and the rebuilding of the station building render it very difficult to operate any type of pump economically. The new turbine unit has been running very successfully, however, and has fully demonstrated that it is adapted to the conditions under which it will be required to operate. The pump is one of the 24-in., two-stage, vertical-shaft turbine type made by Henry R. Worthington. It has an outer annular casing containing two impellers and a set of fixed diffusion vanes. The water enters the top of the casing at the center and is thrown out through the diffusion vanes into the discharge chamber, the vanes corresponding in function to those of a turbine water wheel. The pump is designed to bring about as nearly as possible the complete conversion of the kinetic energy of the water in motion into potential energy of water under static head. This is accomplished by the system of diffusion vanes which are disposed in the throat opening between the periphery of the impeller and the casing. The vanes form tangential, expanding ducts from which the water emerges at about the velocity existing in the chamber. They also tend to eliminate the drag and friction between the periphery of the revolving impeller and the more slowly moving water in the discharge chamber.

The pump is installed just below the level of



Structural Details of Machine Shop, New Orleans Naval Station.

the engine room floor and has a 30-in. suction extending down into the main pump well of the station, with a 30-in. discharge pipe leading from it. It is connected by a vertical shaft to a 1,500-h.p., 2,200-volt, 25-cycle, three-phase General Electric squirrel-cage induction motor just above the engine room floor. The motor and pump are designed to run at 500 r.p.m. The motor has a base guide, while a thrust bearing at the top sustains the weight of the rotor of the motor and the impeller of the pump, together with all rotating parts. This bearing is supplied with oil under about 150 lb. pressure by a vertical triplex Knowles oil pump driven by a geared 1-h.p. induction motor; the bearings of the main pump are supplied with oil by the same pump.

The suction lift of the main pump varies from nothing to 5 ft., and a motor-driven vacuum pump is provided to prime it. The 30-in. suction has a foot valve, while the 30-in. discharge contains a check and also a gate valve just beyond the pump. These valves are designed so the full cross-section of the suction and discharge pipes is available when they are open. The foot valve has avoided any necessity of priming.

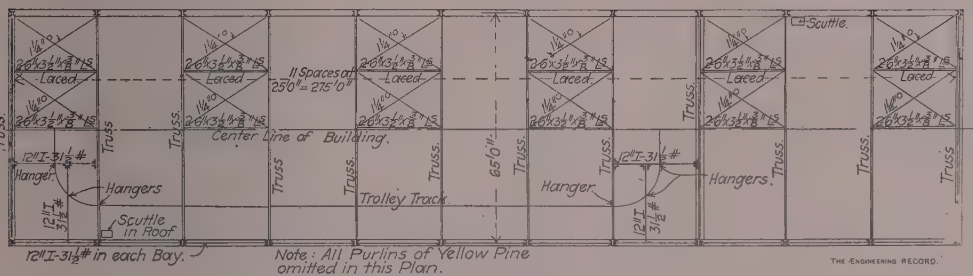
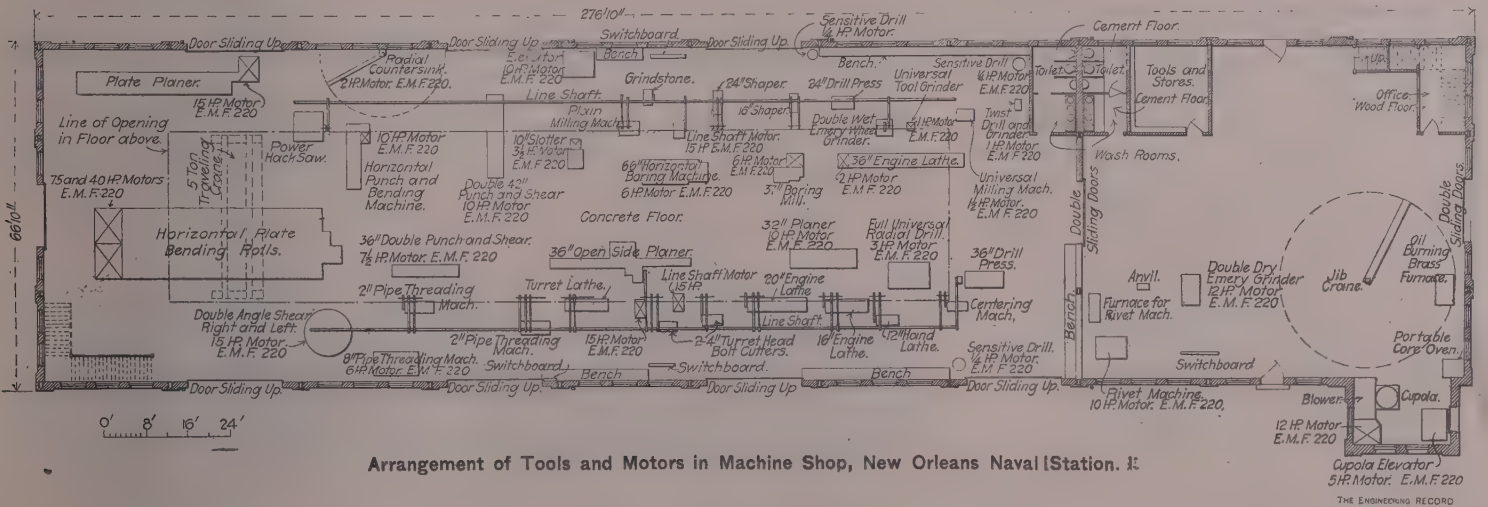


Diagram of Roof Bracing in Machine Shop.


276′10″
66′10″
Door Sliding Up
Plate Planer.
15 H.P. Motor E.M.F. 220
Radial Countersink. 2 H.P. Motor. E.M.F. 220.
Elevator 10 H.P. Motor E.M.F. 220
Switchboard.
Bench
Grindstone.
Line Shaft.
Plain Milling Mach.
24″ Shaper.
16″ Shaper.
24″ Drill Press
Sensitive Drill ¼ H.P. Motor.
Bench.
Universal Tool Grinder
Sensitive Drill ¼ H.P. Motor E.M.F. 220
Line of Opening in Floor above.
75 and 40 H.P. Motors E.M.F. 220
5 Ton Traveling Crane.
Power Hack Saw.
10 H.P. Motor E.M.F. 220
Horizontal Punch and Bending Machine.
10″ Slotter 3½ H.P. Motor E.M.F. 220
Double 42″ Punch and Shear 10 H.P. Motor E.M.F. 220
Line Shaft Motor. 15 H.P. E.M.F. 220
66″ Horizontal Boring Machine. 6 H.P. Motor E.M.F. 220
6 H.P. Motor E.M.F. 220
37″ Boring Mill.
Double Wet Emery Wheel Grinder.
1 H.P. Motor E.M.F. 220
Twist Drill and Grinder 1 H.P. Motor E.M.F. 220
36″ Engine Lathe.
2 H.P. Motor E.M.F. 220
Universal Milling Mach. ½ H.P. Motor. E.M.F. 220
Horizontal Plate Bending Rolls.
Concrete Floor.
36″ Double Punch and Shear. 7½ H.P. Motor. E.M.F. 220
36″ Open Side Planer.
32″ Planer 10 H.P. Motor E.M.F. 220
Full Universal Radial Drill. 3 H.P. Motor E.M.F. 220
36″ Drill Press.
2″ Pipe Threading Mach.
Turret Lathe.
Line Shaft Motor (15 H.P.
20″ Engine Lathe
Centering Mach.
Double Angle Shear Right and Left. 15 H.P. Motor. E.M.F. 220
2″ Pipe Threading Mach.
15 H.P. Motor E.M.F. 220
2-4″ Turret Head Bolt Cutters.
Line Shaft.
16″ Engine Lathe.
12″ Hand Lathe.
Sensitive Drill. ¼ H.P. Motor. E.M.F. 220
8″ Pipe Threading Mach. 6 H.P. Motor. E.M.F. 220
Switchboard.
Bench
Cement Floor.
Toilet.
Tools and Stores. Cement Floor.
Office. Wood Floor.
Up
Wash Rooms.
Double Sliding Doors
Bench.
Anvil.
Furnace for Rivet Mach.
Double Dry Emery Grinder 12 H.P. Motor E.M.F. 220
Jib Crane.
Oil Burning Brass Furnace.
Portable Core Oven.
Switchboard
Rivet Machine. 10 H.P. Motor. E.M.F. 220.
Blower.
Cupola.
12 H.P. Motor E.M.F. 220
Cupola Elevator 5 H.P. Motor. E.M.F. 220
0′ 8′ 16′ 24′
THE ENGINEERING RECORD

Arrangement of Tools and Motors in Machine Shop, New Orleans Naval Station.

Both the pump and the motor rest on a heavy cast-iron bed, 11x12 ft. in plan, which is carried by eight 15-in. I-beams with one end in the footing of a wall of the station building and the other in the footing of the concrete floor of a basement under the engine room. The pump rests directly on the cast-iron base. The motor is carried at the level of its under side on a platform 12 ft. 10 in. square, the latter being supported by four cross-braced cast-iron columns that stand at the corners of the base on which the unit rests. The extreme height of the unit from the lower flange of the I-beams carrying its base to the top of the motor shaft is 24 ft. Its extreme dimensions are thus 12 ft. 10 in. square in plan by 24 ft. in height. The corresponding dimensions of the vertical triple-expansion steam pumping engines of the same capacity in the station are 20x40x44 ft. The electrically-driven unit cost $35,000 installed. The steam engines just referred to and their boilers cost $100,000 to $125,000 installed. The turbine pump requires one man on each shift to run it.

Electric current for driving the motor is supplied by the Cataract Power & Conduit Co., of Buffalo, and is generated in the station of the Niagara Falls Power Co., at Niagara Falls. It is transmitted at 11,000 volts to the city, where it is stepped down to 2,200 volts for distribution. It is further stepped down at the station to 440 volts and the motors driving the auxiliary pumps supplied at that voltage. The current is furnished at a net cost of $4.50 per million gal. of water pumped. The unit runs continuously and pumps against a head of approximately 200 ft., with the suction lift as stated.

In replacing the equipment of the existing pumping station steam pumping engines have been selected in order to have the pumps of one station entirely steam driven and capable of supplying the city with water. The electrically-driven pumping station will also have a capacity equal to the present consumption. The supply will thus not be dependent on one source of power, which if it were might result in unsatisfactory operating conditions. No decision has been made as to whether electric power for the proposed station will be purchased from a private corporation, or generated by a plant to be built and operated by the city.

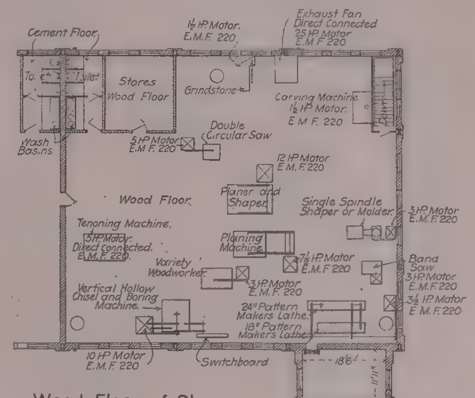
The improvements to the water works are being carried on by the Department of Public Works of Buffalo, Colonel F. G. Ward, commissioner. Mr. Henry L. Lyon, deputy water commissioner, is in charge of the work. Mr. J. B. Cloudsley is chief engineer of the pumping station.

The Peat Block Plant of the Orlando, Fla., Water & Light Co. has a capacity of 113 tons a day. The peat is first shredded like rags in paper making and then rubbed between rollers until the air is squeezed out and it resembles dough. This mass is then formed into blocks in a machine something like a rotary brick machine. The blocks are 4x8x2½ in. as they come from the machine, but dry in the air to a dense stone weighing about 35 per cent. as much as when fresh.

Structural Features of the New Buildings at the New Orleans Naval Station.

By L. F. Bellinger, Civil Engineer, U. S. N.

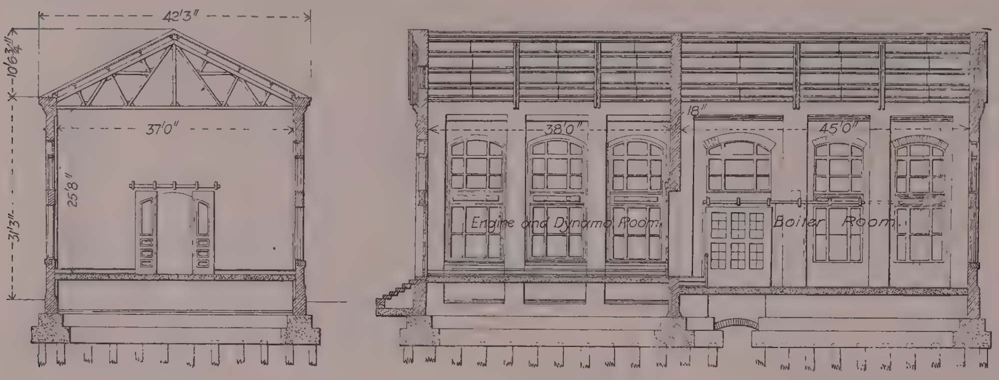
The New Orleans Naval Station, although established many years ago, has only recently been raised to an important rank as a repair yard. The original reservation of 24.7 acres was bought in December, 1848, and had a river front of about 384 ft. In December, 1893, more land was bought, and in 1904 still more, making the total area 213.7 acres. In May, 1898, Congress made an appropriation for a steel floating dock, which was built by the Maryland Steel Co. and towed through the Atlantic, Gulf of Mexico and Mississippi River to New Orleans, in November, 1901. The appropriation of $95,000 for the new machine shop and its accompanying power house was made in June, 1900, and work was begun in November, 1901.



Wood Floor of Shop.

The machine shop is 67 x 277 ft. and is located just across a 60-ft. street from the 40x87½-ft. power house. The buildings were completed late in 1903 and the installation of nearly $92,000 worth of machinery was begun soon afterward. The shop is for the Bureau of Construction and Repair and it was originally intended to supplement it by a 224x60-ft. steel shed for a foundry and machine shop and a 60x40-ft., two-story brick office building. The appropriation was inadequate for them, however, and it was necessary to combine all the shops in one building, thus making it imperative to change the plans, a work which caused considerable delay.

The power house contains three 150-h.p. Babcock & Wilcox boilers fitted to burn either coal or fuel oil, two Laidlaw-Dunn-Gordon, 300-ft., two-stage air compressors, and two 50-kw., 220-volt, General Electric direct-current generators direct connected to single-expansion Harrisburg engines. The generators are connected in multiple for operating a three-wire system with a small balancer. All large motors are 220-volt machines, but there are a few of small size on 110-volt circuits. Both incandescent lamps and 220-volt enclosed arc lights are used for illumination. Westinghouse, General Electric, Crocker-Wheeler and Bullock motors were used. The transmission line is short and run in a tile and concrete conduit from the power house to the main switchboard in the machine shop. Steel conduits below the concrete floor run to various sub-boards, motors and lighting circuits. While the power plant is adequate for present needs, it is intended, under a recent act of Congress, consolidating the power houses at the various naval stations under the Bureau of Yards and Docks, to supply current for this shop by rotary converters of 150-kw. capacity, the power being furnished by a turbo-generator delivering three-phase, sixty-cycle, 2,300-volt alternating current.



Section through Engine and Dynamo Room. Longitudinal Section.

Sections through Power House, New Orleans Naval Station.

Structurally the buildings are interesting on account of their adaptation to a site of poor bearing capacity. Piles were needed everywhere under the footings, and were driven until the penetration under a 20-ft. drop of a 2,000-lb. hammer did not exceed 2 in. In the interior of the shop 35-ft. piles were driven on 4-ft. centers so that heavy machinery can be installed anywhere. The Portland cement concrete was mixed 1:3:6 and the sand was allowed to contain a small amount of silt, not more than 5 per cent., provided the material was generally satisfactory to the officer in charge. The floor of the shop was made by leveling off the ground 10 in. below the finished floor, ramming on it a 9-in. bed of concrete, and finishing off with a 1-in. granolithic course. It may be worth mentioning that there is a crimped iron ceiling over the foundry floor, hung low beneath the girders to prevent dust settling on them.

The only incident during construction that is worthy of note occurred in connection with the roof. The plans show 3x14-in. yellow pine purlins 25 ft. long, without sag rods. These sagged in the middle when the slate was put on, in spite of the aid furnished by the sheathing. This has occurred in some other structures in the vicinity of New York, which have come under the writer's notice, even in spans as short as 15 ft. The tendency of these purlins to sag laterally and overturn when the weight gets on them is often overlooked in designing shop roofs.

The long wood lathe in the wood shop, when working a long piece while it is square, causes much shaking of the floor, apparently on account of the long span of the 3x16-in. joists.

Rapid Track Laying has recently been done on the Rhodesia Ry. in South Africa, where 5¾ miles were laid in 24 hours. The head of the line is now 170 miles beyond Victoria Falls. A full description of the location and construction of this railway was printed in this journal on Aug. 26 and Sept. 2.

A Producer-Gas Power Plant.

A small producer gas plant has been in successful operation with soft coal for nearly two years at the works of the Star Shovel & Range Co., Vincennes, Ind., according to an article by Mr. E. E. Eaton in the "Gas Engine." A 300-h.-p. R. D. Wood & Co. anthracite producer is supplied with soft coal, yet it has been found possible to purify the gas so that the engine can be run 30 days or longer without trouble from tar deposits on the governor and consequent uncertain operation of the engine. The tar is reclaimed as a by-product and sold at $5 per barrel, thus furnishing some revenue from the plant.

The plant was installed in the winter of 1903-4 at a time of reconstruction and modernizing of the works of the company, and it is of interest to note the considerations that led to the installation of the gas engine instead of steam, inasmuch as a complete steam power plant could have been put in for the cost of the gas engine alone. Furthermore, in this district of Indiana, coal is plentiful at $1.80 per ton for 2-in. nut and 50 cents per ton for slack, which renders steam cheap. But on account of the use of gas for heating furnaces for the processes of the shovel department a producer was necessary, so that the addition of the engine to operate with gas also taken from the producer was at once decided upon. Moreover, the small cost of power furnished by such a combination was not to be disregarded in spite of the fact that only 100-h.-p. was required. By use of the producer and gas engine power has been secured for an expenditure of less than 2 lb. of coal per horse-power-hour, Mr. Eaton says, whereas in steam plants with large units and the most economical auxiliaries, it is difficult to generate power with less than 3 lb. per horse-power-hour.

Considerable difficulty was experienced in securing an engine which the makers would guarantee for operation with gas made from bituminous coal, but finally a Nash three-cylinder vertical engine of the four-cycle type was selected. This was guaranteed to develop 100 h.-p. at 250 r.p.m. from the gas made from bituminous coal, providing the gas had a calorific value of at least 150 B.t.u. per cubic foot. The engine is of a design capable of developing 125 h.-p. with illuminating gas, averaging 675 B.t.u. per cubic foot, and is regulated by a throttling type of governor. The engine is started by compressed air, an arrangement of the valve mechanism permitting one cylinder to operate as an air engine for getting into motion while the same adjustment reduces the compression on the other two cylinders to facilitate their starting. When the charge in these two cylinders begins to explode regularly, the starting lever is returned, which restores the compression and the third cylinder as a gas engine. The compressed air for starting is supplied by a compressor attached to the engine, which maintains a pressure of 80 lb. in the storage tanks. The ignition is fixed in all cylinders, not being varied in time with any change of load. Cooling water for the cylinder jackets is pumped out of a cistern by a centrifugal pump belted to one of the flywheels, returning again to the cistern from the jackets. The cistern is supplied by roof drainage and the drains from the producer, which is of the water-cooled type, draining first to the gasometer and thence overflowing to the cistern. There is also an attachment to the city water mains for emergency use in case of stoppage of the pump.

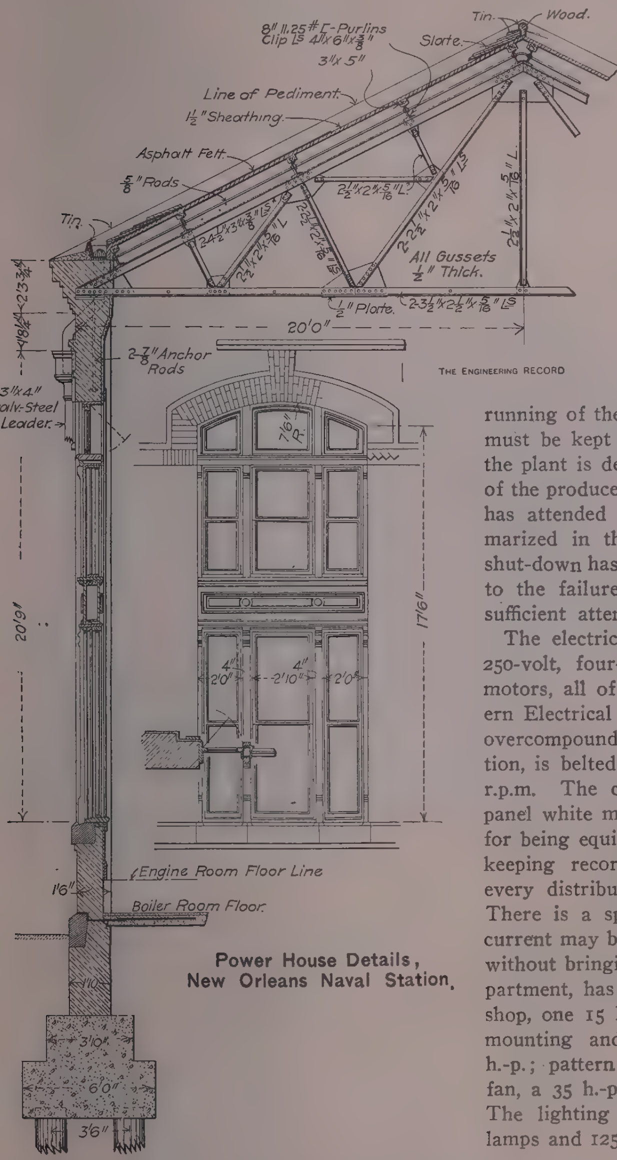
The gas producer is a 300-h.-p. pressure anthracite-coal producer built by R. D. Wood & Co., with a Bildt continuous automatic feeding device. It has a circular grate, not water-sealed, and is equipped with gearing revolving the entire grate for lowering the ashes. The top of the producer is water-cooled. The gas main for the furnaces leads out on one side and is carried then underground to the shovel department. The gas for use in the engine is first passed through a purifying equipment and thence into a 2,000-cu.-ft. gasometer, which, with the sulphur purifier, is located outside the building with underground connections.

The producer room has two floors, the lower of which contains, in addition to the ash pit end of the producer, the economizer, the wash-box, the lower end of the scrubber, different parts of the water seals, from which the tar is removed. etc., and a steam boiler. The boiler is a 35-h.p. vertical fire-tube boiler which is used in the summer for the auxiliary purposes, which require

General View of Power House and Machine Shop, New Orleans Naval Station.

about 15 h.p. for the operation of the producer, about 10 h.p. for the operation of two steam elevators, and some steam in the nickel-plating room and in the shovel department for steaming handles prior to bending. It may be added that in winter steam is supplied by a 65-h.-p. boiler located elsewhere, which supplies the larger quantity of steam necessary for the operation of the Buffalo hot-blast heating equipment of the works.

The upper floor of the producer room contains the top of the scrubber, fans for the purification of the gas by removal of tar, the Bildt automatic coal-feeding mechanism, a coal hoisting conveyor, a well pump, and the line shafting from which this apparatus is driven. This shaft is belted directly to the gas engine, it being estimated that 20 h.-p. is required to drive the whole equipment, or 13 h.-p. without the coal conveyor. In this connection it is interesting to note that inasmuch as this minimum load of about 13 h.-p. is always upon the engine, it must be started under load; is it in fact, reported to have been frequently started successfully with the entire load of 20 h.-p.



Power House Details, New Orleans Naval Station.

The coal is hoisted from a receiving bin alongside a track outside the producer room up to a large coal hopper, from which it is delivered directly into the Bildt automatic feeder so that manual handling is eliminated. The hopper of the Bildt feeder holds about 350 lb. of coal, and, with the average load on the engine of about 80 h.-p. and all the furnaces in operation, this hopper must be filled about three times in two hours, or the equivalent of 525 lbs. of coal per hour. It is interesting to note that the 35-h.-p. steam boiler requires normally about 20 per cent. of this amount of coal for its operation, while in the winter, when the 65-h.-p. boiler is in commission for supplying steam to the heating system as well as for the various other uses, it consumes much more coal than is required for the 300-h.-p. gas producer at full load. When the engine is running under full load for 10 hours per day, about one barrel of tar is reclaimed each week by the gas purifier. As the engine uses about 10,000 cu. ft. of gas per hour this represents the purification of 600,000 cu. ft. of gas for the six days of 10 hours each; the gas delivered to the furnaces is not purified.

The results of the purification are reported to be very satisfactory, so that runs of 30 days and longer can be made without engine troubles. Excellent speed regulation is secured so that the engine can be left without fear of racing. The igniter points are cleaned every morning before starting, although this is said not to be entirely necessary. Two men easily handle the entire plant, the producer tender firing the steam boiler and the engineer caring for the entire electrical equipment. An important feature of the plant's operation lies in the running of the producer, as the quality of the gas must be kept uniform or the entire operation of the plant is deranged. The ashes are cleaned out of the producer every Sunday. The success which has attended the operation of the plan is summarized in the statement that but one serious shut-down has been experienced, and that was due to the failure of some of the piping, to which sufficient attention had not been given.

The electrical equipment consists of a 75-kw., 250-volt, four-pole generator, and nine 220-volt motors, all of which was supplied by the Northern Electrical Mfg. Co. The generator, which is overcompounded 10 per cent. for better regulation, is belted to the engine and is driven at 750 r.p.m. The circuits are controlled on a three-panel white marble switchboard, which is notable for being equipped with recording wattmeters for keeping record of the current consumed upon every distribution circuit throughout the works. There is a special circuit by which the ignition current may be suppled direct from the generator without bringing a ground on it. The shovel department, has three 20-h.-p. motors; the machine shop, one 15 h.-p.; range department, a 10 h.-p.; mounting and nickel-plating department, a 15 h.-p.; pattern shop, a 10 h.-p.; foundry cupola fan, a 35 h.-p.; and the rattling room, a 15 h.-p. The lighting circuits supply eight enclosed arc lamps and 125 incandescent lamps.

A Chimney Gas Temperature averaging 300° C., or 320° at the base of the stack, is as high as it is useful to have, according to a paper by Mr. John W. Cobb in the "Journal" of the Society of Chemical Industry. The velocity of the gases in the chimney will be increased by a higher temperature, but their density will be so diminished that the weight of gases moved will be lower than at the temperature mentioned. Mr. Cobb also points out that a very low temperature at the foot of a stack is not necessarily a sign of economical working, as sometimes asserted, but may be due to a leakage of air between the furnace and chimney. Consequently it is necessary to determine the composition as well as temperature of the flue gases in case thorough investigations are being made.

Reinforced Concrete Structures for Railroads.

One of the railroads which have been most active in introducing reinforced concrete structures for various purposes is the Wabash. Its chief engineer, Mr. A. O. Cunningham, formerly its bridge engineer, delivered an address on the subject before the Association of Civil Engineers of Cornell University, which has been published in its "Proceedings." As a number of Wabash structures in reinforced concrete have been described in The Engineering Record, the following comments by Mr. Cunningham on certain principles and opinions followed in their design are taken from the publication mentioned, which, it should be added, is profusely illustrated:

For bridges above 100 ft. in length there is no question in Mr. Cunningham's mind that steel is the proper and most economical material to use, and for those under 25 ft., reinforced concrete is cheaper and better. Between 25 and 100 ft., the locality will determine the kind of structure and whether it should be steel or reinforced concrete. For small openings under 25 ft. it will be found to be cheaper and just as well to use a flat slab top for spans up to 15 ft., but above that distance the arch is preferable. Sometimes, however, on account of limited clearances, it is often necessary to make even 25-ft. openings with a flat slab top. This is not economical construction usually, so that when spans of this length cannot be made in arches it is generally better to use steel girders with reinforced concrete floors to carry the ballast.

Floors.—In late years engineers have come to the conclusion that there is a great advantage and in the end a saving by placing ballasted solid floors on railroad bridges. Mr. Cunningham considers the advantages to be gained are the following: The roadbed is continuous, thus causing no severe jars or shocks when trains cross the bridge, which is better both for the bridge and for the rolling stock; there is no difference in sound when the train is on the structure from that made on the roadbed except that due to the air while crossing through large structures, and consequently nervous passengers do not get frightened; ordinary track ties are used and these are much cheaper than bridge ties with the necessary guard timbers framed and bolted to them; there is no danger due to the ties burning, with perhaps a consequent derailment. The only attention such a bridge requires is an annual inspection, with an occasional coat of paint. It is never necessary to go to the expense of sending a bridge gang to the structure to line or surface the track, as the section men look after that part of the work.

The great trouble has always been to get a suitable material to support the ballast for solid-floor bridges. Up to within a few years it was customary to build rectangular and triangular troughs of iron, fastened at their ends to the girders or trusses which acted as floor beams and in which were placed the ballast and ties. These have always been found unsatisfactory, not only on account of the noise during the passing of trains, but for the reason that there was no way of ascertaining the amount of corrosion that had taken place with the consequent weakening of the floor. They also were a source of great annoyance because they would leak. Then, furthermore, they were extremely costly. These floors are seldom used now, being supplanted by a cheaper and better construction. Instead of the troughs, rolled I-beams are placed at intervals of about 18 in. crosswise with the track and attached to the main girders, and upon the tops of the I-beams steel plates are riveted to carry the ballast. These floors are hard to maintain and always corrode and leak. In order to deaden the sound a similar floor was brought out, but instead of using steel plates on top of the I-beams, creosoted timbers about 4 inches thick were placed thereon, the joints between the timbers being caulked. These are a great improvement over the previously mentioned kinds, but are not entirely satisfactory.

Because of these imperfections, Mr. Cunningham designed a bridge floor using reinforced concrete in the form of a slab. Several floors of this description have been built and when waterproofed on their upper surface have proved entirely satisfactory. In most cases it is not necessary for the floors to be completely water tight, and in such cases holes are made in the slab between the I-beams to allow the water to drain out. Waterproofing is not then required. Since the adoption of this design by the Wabash Railroad, several other roads have tried reinforced slabs, varying the design somewhat, and in most cases these have been found to be very satisfactory.

The reinforced slab which has been made the standard for all girder bridges on the Wabash is 6 in. thick at the center, increasing in thickness to 8 in. at the girders, thus allowing the water to drain from the sides to the center and through the slab by holes between the I-beams. It is impossible to design the slab theoretically, therefore common sense has to come to the rescue. Formed bars of one-half inch section are used. In a longitudinal direction with the bridge they are placed 12 in. apart, 1½ in. below the top of the slab, and in the bottom they are spaced 6 in. on centers within 1½ in. of the bottom of the slab. In a transverse direction they are spaced 18 in. on centers and rest on the bottom longitudinal bars. The reason for placing the bars thus is because the slab is assumed to be a beam over several supports, hence requiring tension members in the top of the slab over the supports or I-beams, and in the bottom of the slab between them. The bottom of the slab has further work to perform, due to the deflection of the main girders, consequently there are twice as many longitudinal bars in the bottom as in the top of the slab. The bottom of the slab has still more work to perform, and that is when the I-beams deflect, thus requiring rods parallel to them to prevent longitudinal cracks in the bottom of the slab.

Main Aisle of Machine Shop and Horizontal Plate Bending Rolls, New Orleans Naval Station.

There is another kind of floor designed by Mr. Cunningham to take care of places where the underneath clearance is small. In this case the I-beams are punched in the webs near the bottom flange. Rods spaced 6 in. on centers are threaded through these holes. Transverse rods, one on each side of the I-beam and one between them, are laid on the longitudinal rods, and the concrete slab of the same section as in the previous design is laid on the bottom flange of the I-beam and built around them, covering them and leaving a rectangular trough about 12 in. square between them. In this trough the ballast and ties are placed. Holes are made in the center of the slab between the I-beams to drain off the water which is collected in a gutter placed in line with the holes beneath and carried by downspouts to the street curb lines when necessary.

Culverts.—Of all the different uses to which the railroad engineer can put reinforced concrete there is no place in which it can be employed to better advantage than in small openings up to 15 ft. Such openings can be spanned with reinforced slabs just as cheaply as with steel girders, but with the added advantage of having a more permanent structure carrying the roadbed with ballast and track ties, thus doing away with any maintenance expenses. These slabs are very easily and quickly built in place, but cannot be constructed to advantage in freezing weather.

As reinforced slabs to carry railroad trains must necessarily have quite a depth, the best form of construction is that which will enable the bars to take care not only of the tensile stresses but also of the shearing stresses along horizontal planes. Failure in deep reinforced beams takes place by the disrupting of the concrete in a horizontal direction just above the bars at the end supports, and to prevent this the bars in the bottom are bent up at their ends at an angle of 45 deg., thus firmly uniting the upper and lower strata of the beam and preventing them from slipping on one another. This method of laying the bars in the concrete has the added advantage of an anchorage for the reinforcement, thus preventing any slipping and pulling out of the bars.

When constructing slabs it is well to have nothing but mortar next to the bars, using a mixture of one part of cement and two parts of sand, and when the bars are entirely covered, build up the rest of the slab with concrete, using one part cement, two parts sand and four parts of broken stone. If it is impossible to build the whole slab in one day it is better to divide it up into longitudinal strips by wooden bulkheads, completing strip from bottom to top without stopping work. Some engineers recommend placing all the bars before beginning the concrete work, but Mr. Cunningham generally prefers, wherever possible, to put the rods in while concreting is in progress, for it is a much more rapid method. The work must be done continuously and the successive layers of concrete deposited rapidly, especially at a point where a number of bars are to be placed, in order that the concrete on which the bars rest will not even get its initial set before the next layer of concrete is placed; otherwise there will be a weak horizontal section at a point where strength is necessary.

Arches.—When the distance to span is too great for a slab, then resort is made to the arch. Arches, of course, take much less material than slabs, but they are more costly to build, due to the forms. It is best to have a standard form of arch for railroads, so that the arch centers may be used over and over again. To do this, designs should be made of arches differing in length by five feet, commencing with a 10-ft. arch and ending with one 40 ft. in length. It is seldom that a greater length arch will be employed, hence there is no need of a standard above this length.

It is generally found that the arch ring may be made astonishingly thin, but it is always good practice to increase this 2 or 3 in. in the short spans, especially if the top of the arch comes close to the base of the rail, to take care of the heavy shocks caused by rapidly moving unbalanced locomotives. There are so many forces caused by a moving train which all the theory in the world would not account for that it is always better to provide a little more material than theoretically required to take care of those forces. Even when this precaution is taken, a weak place developing cracks will sometimes appear. Rods should be placed both on the intrados as well as the extrados, and diagonal shear bars should connect these top and bottom bars together. Bars should be placed also in the abutments, and when necessary the abutments should be held together by a bottom stab in which are placed bars.

Abutment.—The meanest structure for a railroad engineer to contend with is a high concrete abutment, because of its weight, due to the amount of material necessary for its stability. When pressure back of such an abutment is applied, on account of earth or a superimposed live load, or when the abutment supports a steel structure which, due to temperature, is shrinking in length, then an increased pressure is brought on the earth foundation at the toe much greater than perhaps anticipated or than any soil is capable of withstanding, and something happens. Generally the abutment tips forward and vertical cracks appear at the juncture of the wing walls with the main body of the abutment. If the structure is of stone masonry instead of concrete, cracks are not so liable to appear, as the joints between the stones open up slightly and what would appear as a crack in concrete is not noticed in stone masonry. For this reason it is good practice to put rods in all concrete abutments. Whenever this is done the amount of concrete can be much reduced by making the abutment of such form that the downward pressure of the earth behind it will keep it in equilibrium.

There are several advantages to be gained by such an abutment: (1) the weight on the soil beneath it is much lessened, therefore there is less likelihood of tipping forward: (2) the rods in the concrete will prevent it from cracking; (3) the cost of the structure, if of any size, will be reduced. Such an abutment, the first of its kind ever built, was designed by Mr. Cunningham for a railroad viaduct at Monticello, Ill. This has its drawbacks, for it requires more care in its construction and should be finished on the back as well as the front; otherwise water will seep through the comparatively thin face walls. Then water-soaked thin walls of concrete may be injured in time by freezing.

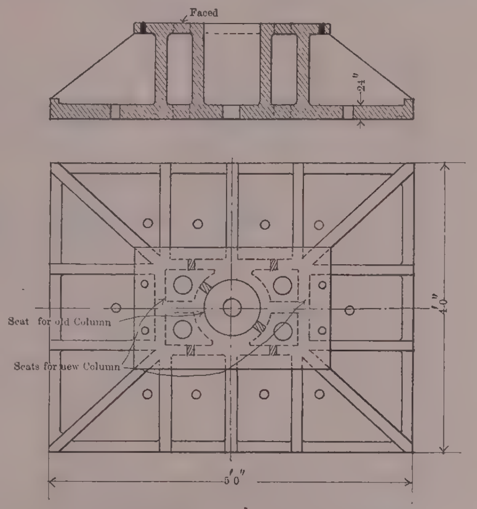
Taking up the design of such an abutment there is first necessary a rectangular slab for a base. Near the front of one of the long edges of this base a vertical face wall is built. Connecting this face wall to the base, vertical rectangular ribs are constructed and upon the tops of these ribs another horizontal slab is formed. Upon the back edge of this top slab another thin vertical wall is built. This last is the back wall. The upper horizontal slab is the bridge seat, and the rectangular ribs act as columns in carrying the bridge loads to the base. The lower vertical wall retains the earth. The above description gives an idea of the method necessary to follow in designing such a structure. The base distributes the pressure on the ground and must be designed as a continuous uniformly loaded beam, its supports being the rectangular ribs. The lower vertical face wall acts as a slab to retain the earth and is held at its ends by the ribs; this is also a continuous beam uniformly loaded. The ribs perform the double duty of carrying the bridge loads to the base and besides anchoring the face wall to the base. The rib must, therefore, be designed first as a column; then, in addition, as a cantilever beam. The only duty the upper slab performs is to tie the tops of the ribs together so that only sufficient rods to do this are required. That part of the back wall formed by the continuation of the ribs must be considered as a cantilever beam supporting the vertical wall between them, this wall being treated as an ordinary beam. Retaining walls are designed in a similar manner but without the bridge seats and back walls.

Reinforcement.—The kind and quality of reinforcement to use is worth careful consideration. The users of plain bars argue that the adhesion between the concrete and the bar is good enough to require no artificial bond, and in fact some people go so far as to say that there is a chemical union between the cement and the steel. In setting in air the concrete contracts, tightly gripping the bar and forcing small particles into the minute uneven places on the surface of the bar. We then have mechanical bond. Suppose the bar is pulled to its elastic limit; it increases in length and the cross section decreases, of course a very small amount, but enough to damage the bond. The pull is now taken off the bar and it resumes its former section. Many repetitions of this sort will spoil the bond entirely, and it is reasonable to suppose that shocks will break this bond. Hence the necessity for using some kind of deformed bar.

We come finally to the question of deciding whether the bars should be made of medium or high steel. Engineers who prefer medium steel argue that since we would not think of using high steel in bridges because of its comparative brittleness, we should not use it in concrete either. Then they say that since cracks develop in the reinforced concrete when the steel is stressed between 12,000 and 15,000 lb. per square inch, there is no sense in using the high grade of steel. These sound like good arguments but they are not. The high grade steel with an elastic limit of 50,000 lb. per square inch is the best to use, not only because it is more economical, but for the fact that less section of metal is required than with medium steel in beams of equal strength, thus allowing a greater amount of concrete between the bars. In a deep beam to carry railroad traffic this is a matter of some importance, otherwise it is necessary to put the rods in two rows and thereby further increase the depth of the beam.

The argument that since medium steel is used for bridges we should also use it for reinforced concrete is not sound, because steel in bridges is in large sections and therefore with great liability of having flaws somewhere, whereas the bars are of small section, with no such chances. Bridge material is punched, riveted and mistreated in every possible way, while this does not happen to the bars. Then the bars are embedded in a softer material so that any shock that reaches them is absorbed by the heavier and softer mass of concrete.

In all railroad structures it is always necessary to provide for future live loads, because engine and even freight car loads are increasing in weight every year. Here is where reinforced concrete has such an advantage over other materials, because as the years go by the concrete is gaining strength, and so, within reasonable limits, the older it gets the greater the loads it is able to carry. In providing for live loads a safety factor of four should be used; this would mean a working unit stress in the concrete of 500 lb. per square inch in compression and 100 lb. for shearing, and in the steel 12,000 lb. per square inch if it be of the high grade. For the dead loads these limiting stresses may be increased one-third.



Column Base, Mercantile Building.

It must be understood that in using the above unit stresses for railroad bridges, there must be added to the live load stress a certain amount of impact stress, depending upon the proportion of the dead load to the live load. The impact stress used by Mr. Cunningham is the quotient obtained by dividing the square of the live load stress by the sum of the live and dead load stresses.

STREET GRADE CHANGES were the basis of a curious theory put forth by counsel in Swope v. City of Seattle, 78 Pac. Rep. 607. The measure of damages for lowering the street grade in front of the plaintiff's property could best be estimated, it was claimed, with the aid of mortality tables, introduced to show the expectancy of the plaintiff's life and accordingly the length of time during which he would be subject to the additional burden of climbing the steps rendered necessary by the grade revision. No authorities were cited and the court denied the contention, stating that counsel had mentioned no rule of law justifying offering such tables.

Reconstruction of the Mercantile Building, New York City.

The 92x156-ft. Mercantile Building at 16th St. and Broadway, New York, was originally six stories high, with self-supporting brick walls and two interior longitudinal rows of circular cast-iron columns supporting pairs of iron I-beam floor girders. One of the rows of columns did not extend the full length of the building, but was replaced at one end by a brick wall into which the floor girders were built. To improve the property for commercial purposes it was determined to tear down the upper story, add six more stories, making eleven in all, and to extend the building by a full height, 20x100-ft. steel-cage addition on the east side. This plan involved the retention of the old exterior front walls and most of the columns, girders and floors, the removal of the interior longitudinal wall and all partitions, stairs and practically all the woodwork and trimmings, and the installation of an entirely new equipment for heat, light, power, electric and sanitary service.

The foundations, outer walls and interior columns were too weak to carry the additional stories, and Maynicke & Franke, the architects who designed and supervised the improvements, were confronted with a difficult and unusual problem which has been successfully solved in an interesting manner. It was found impossible to drive concrete foundation piles as contemplated, on account of the numerous boulders encountered by the preliminary borings made by Mr. Watson G. Clark. Wooden piles were unsuitable because the ground water does not rise high enough to keep them saturated and prevent decay. As the rock is about 20 ft. below the old footings it would have involved great expense and risk sink reinforcing piers alongside of them to the rock. Therefore, being unable to secure an unyielding foundation for the new loads a construction was adopted which makes the old and new foundations for each pier act together as a unit, thus obviating the danger of stress or displacement between the old and new portions of the superstructure.

Temporary underpinning for such a tall and heavy building is tedious, difficult and sometimes hazardous, and it was avoided as much as possible. The old foundations were retained and were reinforced by a system of underpinning so designed that under all conditions of loading the uniformity of pressure is always maintained on both the old and the adjacent new footings, thus insuring regularity in the settlement if any occurs.

The foundations for the interior columns were reinforced by pairs of adjacent new footings at the same level, which with the old footings supported grillage beams on which the concentric old and new columns were seated on new cast pedestals and carried their respective loads from the old and new floors.

The reinforced footings of the street wall piers carry steel columns against the inner faces of the walls. These columns are connected by girders in all the old stories on which the old floor beams are wedged up to bearing to transfer to them the floor loads formerly carried by the wall masonry. Above the sixth story the floor beams and girders are carried directly by these columns which also support the upper stories of the wall masonry on cantilever girders.

The party wall on the south side of the building and its footing was examined and found to be adequate for the reconstruction and was not disturbed; the rear wall on the east side of the building will be entirely removed to allow for the extension of the rooms to the new outer wall about 25 ft. farther east, and the street walls on the north and west sides will remain practically undisturbed and self-supporting up to the fifth floor, above which their extensions will be carried by new steel columns. These walls consist practically of masonry piers between large window openings, and it was calculated that their footings on the dry, sandy soil about 20 ft. below the curb were not adequate for the additional loads of as much as 165,000 lb. each in some cases which will be imposed on them by the new upper stories. It was, therefore, determined to reinforce these footings as well as those of all but two of the old columns, and to build seven new footings for the additional new interior and exterior columns, all located as shown in the foundation plan, where the new footings and parts of footings are indicated by shaded areas.

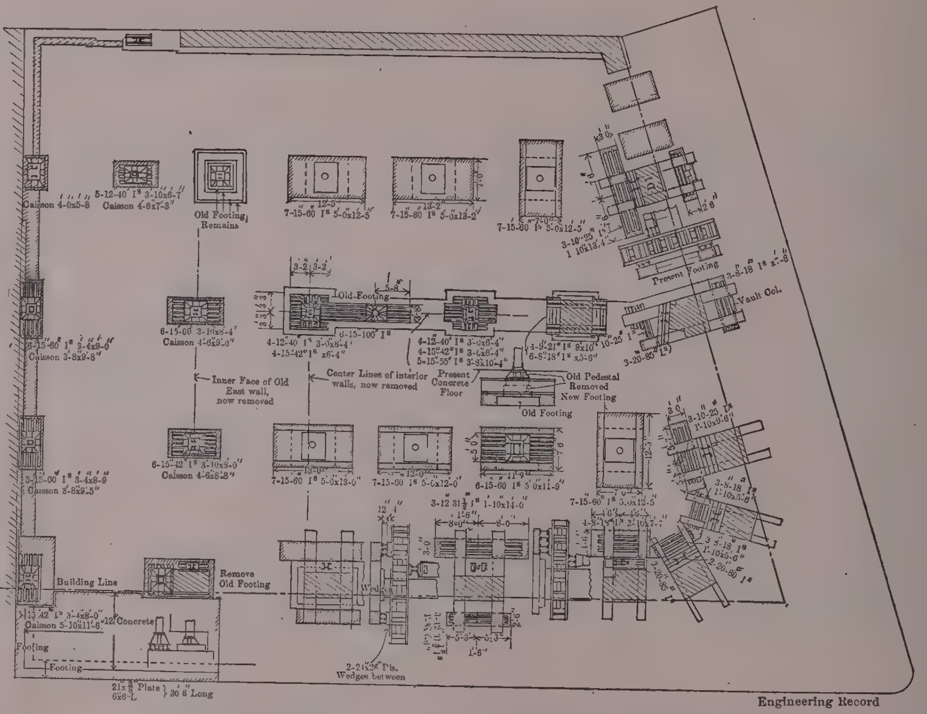
In order to secure uniform action and as far as possible balanced loads between the new and old wall footings so that the pier and column shall act as a unit, a part of the pier load and all the column load in each case is carried by a pair of heavy girders one on each side of the pier, which have bearings continuous across the old and new footings. At first it appeared difficult to underpin the piers and distribute the old and new loads between the three footings at each pier, and various plans were proposed, among them the support of the old footing on a number of beams or girders tunneled under or through it.

Finally the work was accomplished very simply and safely by first building the two new footings close to the old one at every pier and then cutting a horizontal notch or slot in one side of the pier masonry, just above the footing, large enough to receive one of the transverse box girders which was immediately wedged up until a moderate pressure was developed between its top flange and the upper side of the slot in the pier masonry. Wedges were driven under the center of the girder between it and the old footing and the girder was carefully leveled. Then a notch was cut in the opposite side of the pier and the other girder was similarly wedged into position. As these operations did not leave much more than 20 per cent. of the pier cross-section unsupported at any given time, the stability was never seriously impaired. A longitudinal girder was seated on the transverse girders close to the face of the pier to carry the new column, and the grillage beams were wedged up to bearing against the transverse girders, and the spaces around all the wedges under the girder flanges were grouted, making permanent bearings of such a nature that neither the pier nor the column can settle alone and any material addition to the load on either will be distributed over all footings which will adjust themselves to the loading.

The footing girders are from 16 to 19 ft. long and all are 30 in. deep; some of them have simple webs and some have double webs 7 to 10 in. apart in the clear. All are made with flange cover plates and four 6x6-in. flange angles, and all have several pairs of 6x6-in. vertical web stiffener angles and fillers at bearings. Most of the columns are seated on two or three deep I-beams, which act as distributing girders, but two of them are seated on box girders 8½ ft. long and 24 in. deep, made with two ⅝-in. webs, 10 in. apart, and four 6x4x1-in. flange angles, without cover plates.

The old circular cast-iron interior columns are of the ordinary type with brackets for the pairs of I-beam girders and are seated with extended cast pedestals on masonry footings similar to those of the wall piers. On each side of each column vertical shores were set in each story and wedged up to support the pairs of I-beam girders close to the columns. The basement shores were spaced about 8 ft. apart in the clear, for each pair, and were seated on sills between which space was left for excavating and constructing the pairs of new footings or extensions on both sides of the old footing. After these were made the shores were wedged up to take the floor loads and the columns were lifted from their bases and held suspended from the girder connections. The old pedestals were removed and the old footings cut down to receive grillages of I-beams continuous over them and the pairs of adjacent new footings. The grillages were bedded in cement mortar or concrete which was filled into the interstices between the webs and new pedestals were seated on the grillages and the old columns and the reinforcing new ones were lowered a small fraction of an inch to bearing on them, thus securing a new compound footing so arranged that all parts of it must settle alike if any settlement occurs.

The interior brick wall, indicated by dotted lines in the basement plan, supported the ends of the floor girders and the latter were shored up as has been described for those carried on the interior columns, and the wall was removed entirely, portions of its footing being left, in some places to support new steel columns in the plane of the wall to carry the floor girders. These columns have cast-iron pedestals seated on grillages of longitudinal I-beams which distribute the column loads over enough of the old footing to make the pressure about uniform with that on the wall footings and thus provide for uniformity in any settlement or compression of the soil.



Plan of Foundations, Reconstruction of Mercantile Building.

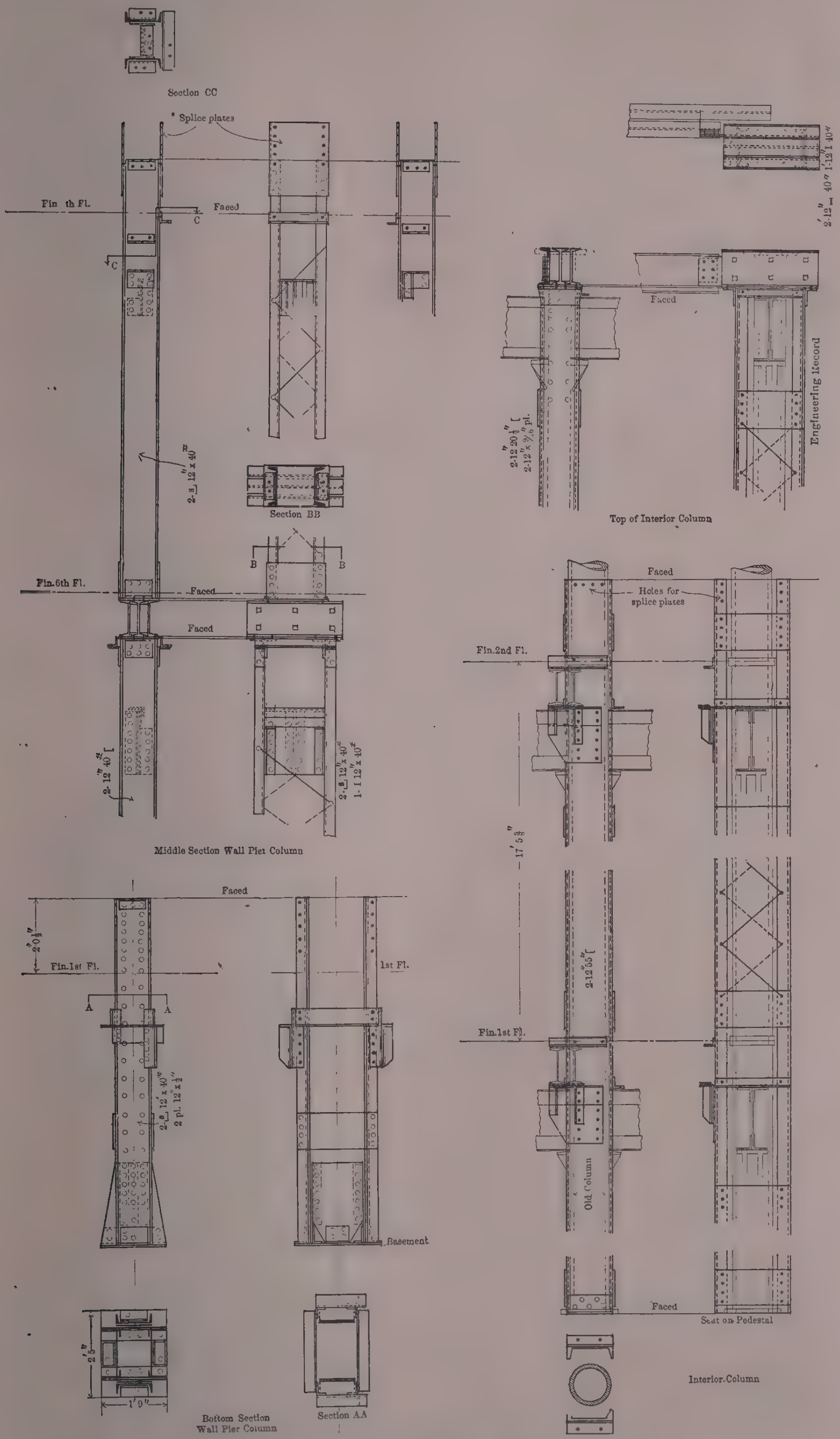
All of the new columns are made with two rolled channels, latticed. Column D1 at the corner pier, is special to receive the old floor girders at angles oblique to the face of the column. It is made wide and flat so as to be contained in a pilaster and not project far beyond the face of the wall. The foot is stiffened, as shown in the detail, with double transverse diaphragms and vertical reinforcing channels to distribute the pressure on an extended base plate seated across the top flanges of the column girders. The first floor girders are supported on horizontal shelf angles forming a belt around the outside of the column, and the oblique upper girders are carried on reinforced diaphragms riveted between the column webs. The splices are made about 1⅓ ft. above the floors with horizontal flange angles and pairs of field-riveted vertical flange cover plates. At the sixth floor (at the top of the old walls) the column is capped by a set of short horizontal 12-in. I-beams, bolted together with separators and seated on the faced ends of the column channels. These beams have top and bottom flange cover plates, and are essentially reducing girders which distribute the load from the narrower upper sections of the column.

In order to divide the loads of the new and old stories between the new and old interior columns the construction shown for column B4 was designed. Up to the sixth floor it is made with a pair of 15-in., 55-lb. channels with their flanges turned inwards, 2 ft. apart, back to back, with field-riveted lattice bars and tie plates connecting the flanges. This arrangement enabled the two channels to be placed separately on opposite sides of the existing cast-iron column and assembled and riveted together to enclose it permanently without moving the old column or disturbing its loading. Care was taken to space the lattice and tie plates to clear the old floor girders and bracket plates and angles were riveted to the channel webs to support the old floor beams eccentric to the column.

The column was made in three two-story sections spliced with web and flange cover plates. The lower two sections have 15-in. channels and the upper section, 12-in. channels with pairs of filler plates riveted to the lower ends of their flanges to extend the bearing to match that of the adjacent wide section. The top section is capped by a 12-in. I-beam and two channels about 2½ ft. long, bolted together to make a rigid girder which receives the foot of the sixth story column and transfers its load through both sides of the lower story sections to the old footing of the cast-iron column without increasing the load on the latter.

On the Twentieth St. front of the building the outer ends of the floor beams in all stories are carried on pairs of 15-in. I-beams connected to the new pilaster columns alongside the old five-story piers. These beams serve as fulcrums, the floor beams resting on their top flanges and cantilevering two or three feet beyond them to carry the framing for the large glazed spaces between the piers. At the Broadway corner the outer wall is curved more than 90° to a radius of about 12 ft. and the two pilaster columns located in it are braced together and to the adjacent interior column by single 10-in., 15-lb. channels, laid flat in each floor and forming triangular trusses which afford rigid lateral bracing.

Above the sixth floor the old wall piers are entirely discontinued and all the new wall masonry is carried by the new pilaster columns from 4 to 6 ft. beyond their center lines. In these floors the girders are 20-in. I-beams parallel to the 20th St. wall and are connected to the wall columns on their center lines and carry the 12-in. I-beams about 5 ft. apart. At column points these 12-in. I-beams pass through the columns, between their channels, and project outside them to the inner face of the wall, where their cantilever ends are web-connected to 15-in. channels, which form continuous wall girders with brackets and offset I-beams to carry the masonry and window framing.

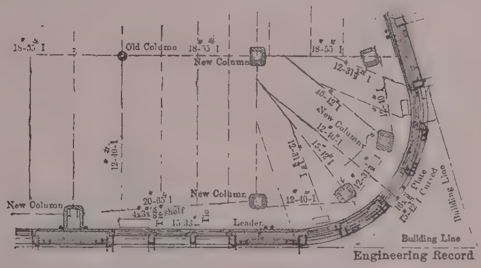


Details of Wall and Interior Columns, Mercantile Building.

The new elevator shafts are located adjacent to the old wall of the building and the ends of a number of floor beams at right angles to the wall had to be cut off to clear them. This of course deprived the beams of their original support at the walls and in order to avoid additional columns to carry their cut ends the old beams adjacent and parallel to those which were cut were, where necessary, reinforced or supplemented by new beams parallel and close to them, and from them were suspended new transverse beams with their top flanges bearing against the bottom flanges of the reinforced beams and receiving the ends of the cut beams.

The architects believe that there is no precedent for this method of reinforcement and arrangement and insertion of girders for the foundations of the wall piers, and that the system of concentric new columns enclosing the old ones, resting on the same bases, and relieving the old ones of the loads of the upper stories without disturbing their support of the lower stories, has only been used once before, the previous application being in the reconstruction of the "Judge" Building, New York, which they designed and supervised. A somewhat similar result was attained by Mr. Maynicke a number of years ago when on the staff of Mr. George B. Post he designed the addition of upper stories to the Times building, Park Row, New York, and carried the upper story floor beams on wall columns seated on short girders capping one column inside and one column outside the original wall which still continued to carry the lower floors as at first, but received no load from, and was independent of, the new upper floors.

The support of the floor beams originally carried by the east wall was transferred to the new columns replacing the wall by an ingenious method which wholly dispensed with shoring, and effected considerable economy besides being simple and rapid. Holes were cut in the wall to clear the new column footings and the columns were erected in halves, one-half on each side of the old floor girders, passing through holes cut in the floors and field-riveted together after erection. The old girders thus passed between the channels forming the new columns and projected a few inches beyond them on the outside where they entered the old wall. Shelf angles were riveted across the column flanges just below the bottom flanges of the girders and they were wedged up to bearing on them so as to transfer their loads to the columns and release the wall. Holes were cut in the wall each side of the girders at each floor, without disturbing the girder seats in the wall, and through them the pairs of I-beams forming the girders in the extension of the building beyond this wall were entered and seated on each side of the projecting end of the old girder, on horizontal shelf angles on the column. Both floors were thus made independent of the old wall, which was removed and its bricks cleaned and used again in the new wall masonry without lowering them to the ground.

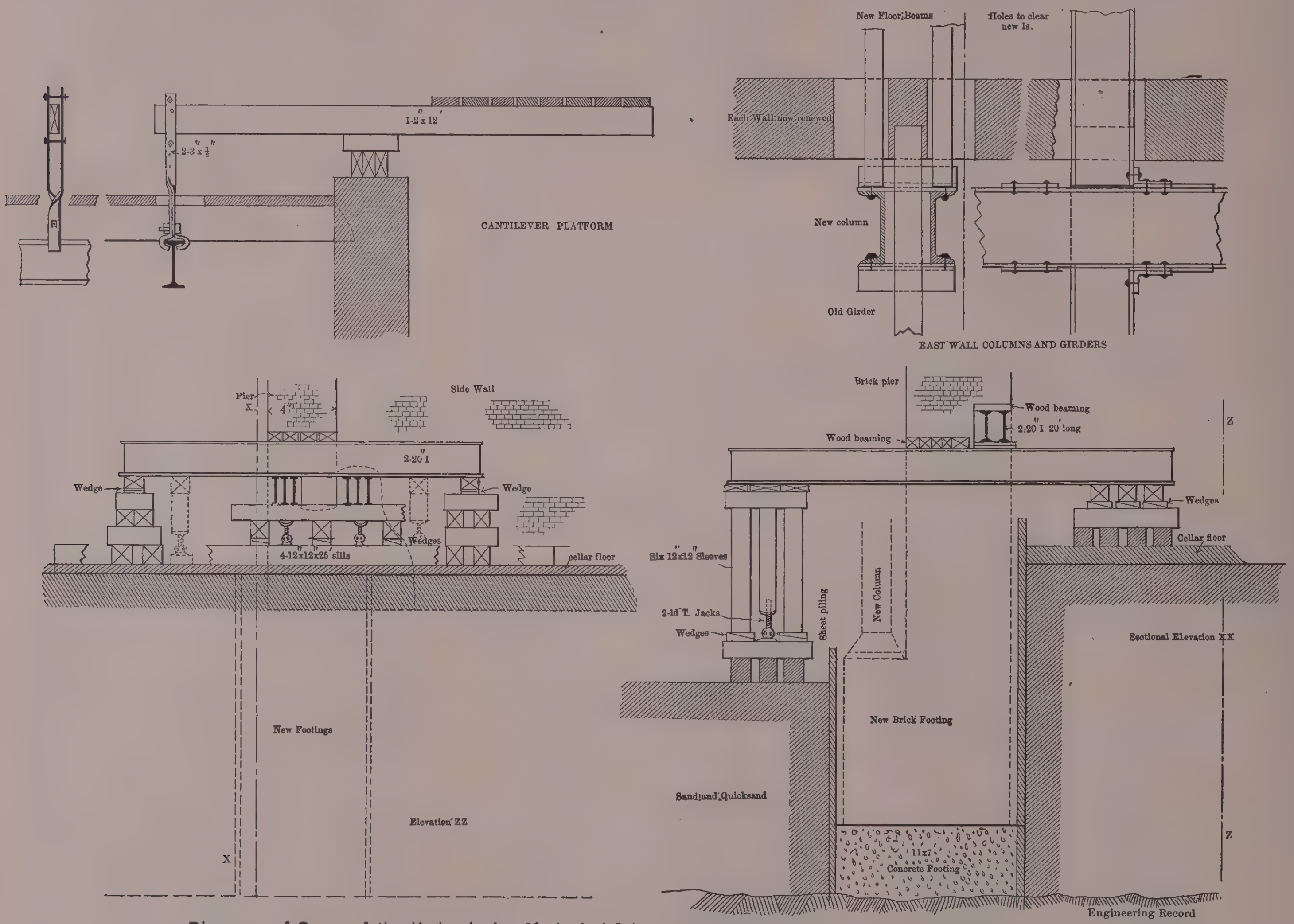


Location of Old and New Columns.

The reconstruction of the building was commenced by removing all interior partitions, stairways and other construction except the outer walls and floors, and by cutting small holes in the floor around all interior columns and at the wall piers to enable the shores to be set to carry the floor loads during the reinforcement of the columns and piers.

A false roof of matched boards on planks, edgewise, nailed to light vertical posts seated on the fifth floor, was built about 4 ft. clear of the sixth story ceiling to protect the interior of the building from leakage through the various openings in the sixth floor. The old roof and sixth story ceiling for the upper stories were commenced at the sixth floor level, materials being hoisted from the street by a stiff-leg derrick set on cantilever beams with its mast outside the east wall of the building. It had a 30-ft. steel beam extended about 15 ft. by a timber telescoped inside at the point. An 8-ft. working platform around the outer walls of the building just above the 6th floor level was supported on cantilever beams about 10 ft. apart, made, as shown in the sketch with cantilever planks fulcrumed on the walls and anchored by adjustable vertical bars and clamps engaging the top flanges of the floor beams.

At the northeast corner of the old building new footings were required for the old pier and for a new column to carry the floors of the extension, and both of them were carried down about 10 ft. below the cellar floor to bearing on rock. In order to build them it was necessary to underpin the old pier and a portion of the adjacent wall so as to support the superstructure while the old foundations were removed. This was accomplished by notching one side of the pier just above the cellar floor and wedging to bearing there a pair of 20-in. transverse I-beams about 25 ft. long supported on cribbing at both ends. These provided security for the pier while a portion of its footing was removed and another notch cut in the adjacent outer face to receive a set of three longitudinal I-beams similarly supported. A second set of three more longitudinal I-beams were put through a hole in the side wall as close as possible to the first three, and the upper I-beams were wedged up to bearing on the top flanges of all six longitudinal beams, thus fully supporting the pier and allowing sufficient clearance under them between their end supports to remove the old footing and construct the new ones in a sheeted pit which was excavated with some trouble on account of the large amount of water encountered which required constant pumping. The upper I-beams were brought to bearing against the pier masonry by the six 10-ton jack screws indicated by dotted lines and then the loads were transferred by wedging to the end cribs and the jack screws removed and put under the longitudinal I-beams where they were maintained to provide constant adjustment and take up any possible settlement which might be noticed, any movement of the screws being, of course, followed up by driving the wedges under the adjacent shores.



Diagrams of Some of the Underpinning Methods in the Reconstruction of the Mercantile Building, New York.

Charles A. Cowen & Co. are the contractors for the foundation work and masonry. Mr. Saul Weiskopf, consulting engineer. T. P. Galligan's Sons are the sub-contractors for the underpinning and shoring. The steel in the new extension and in the foundation reinforcements is furnished by the Hay Foundry & Iron Works, Mr. E. W. Stern, engineer, who made the shop drawings for the foundation steel.

EXCAVATION BY HYDRAULIC SLUICING was employed in removing over 150,000 cu. yd. of clay from the site of the new power house of the Metropolitan Street Ry. Co., of Kansas City. The water was taken from the city mains and washed the clay into a neighboring outfall sewer. A temporary pumping plant also furnished water to the sewer to flush the clay from it.

The Steel Shed of Pier 7, South Brooklyn.

Pier No. 7 on the South Brooklyn water-front in New York harbor is a one-story steel structure for the large terminal under construction by the Bush Co. It is 1,190 ft. long, 143 ft. 4 in. wide and about 30 ft. high. The construction is of interest from its simplicity and uniformity, which facilitated the erection with unusual rapidity. There are, as shown in the diagram, four longitudinal rows of columns, those on the outside being spaced 15 ft. apart and those in the two interior rows 45 ft. apart, so as to be in the transverse planes of every third pair of wall columns. The interior columns are connected by deep but light longitudinal trusses which, with the wall columns, support the transverse roof trusses 15 ft. apart. The top and bottom chords of the transverse and longitudinal trusses are in the same horizontal planes, and are connected with field-riveted gusset plates, so as to form a rigid system of longitudinal and transverse bracing, without the necessity for additional struts.

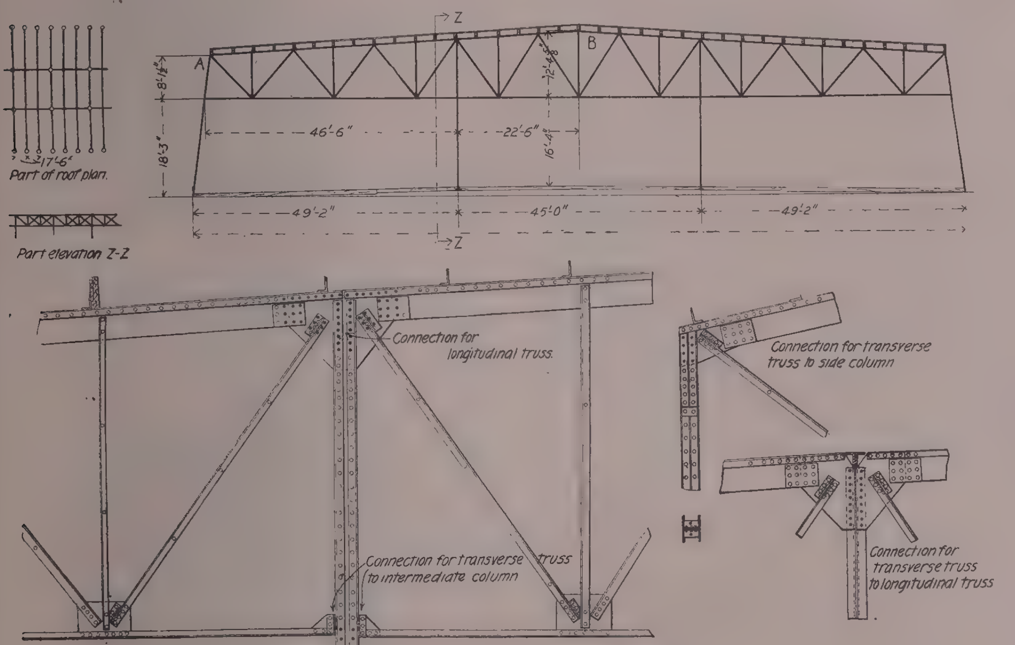
All the columns have H-shaped cross-sections made of two pairs of light 5 x 3-in. flange angles and a web plate, and all have base plates bolted to the timber deck of the pier. The outside columns are battered 2½:12 and at the upper end have the web plate out shorter than the flange angles so that the latter form jaws field-riveted to the end connection plate which is shop-riveted in the transverse side roof truss. The center columns are made heavier than the side columns and the extended base plates are reinforced by vertical stiffening angles. At the upper end there is a short section of web plates much wider than the column which projects both sides to serve as a connection plate for the end top chords and diagonals of the transverse roof trusses, which are field-riveted to it. Most of the rivets through this plate and the flange angles are field driven and serve for the connection also of the column to the top chords of the longitudinal trusses.

The longitudinal trusses are 11 ft. 4 in. deep and have T-shape top and bottom chords made of pairs of 5 x 3 x ½-in. and 4 x 3 x 5/16-in. angles respectively. The web members are pairs of 5 x 3-in. angles back to back except the counters, which are single 2½ x 2½-in. angles. The connections are made by gusset plates riveted between the vertical flanges of the pairs of angles and having at the ends of the top and bottom chords short vertical angles for connection with the intermediate vertical columns. The outstanding flanges of the vertical members of the trusses have field-riveted connections for the transverse roof trusses which are connected to them with single vertical rows of rivets through the gusset plates at the ends of their top and bottom chords.

The transverse trusses for the side spans are 46½ ft. long, 8 ft. 1½ in. deep at the outer end and 10 ft. 11¾ in. deep over all at the inner ends. The T-shape top chord acts as a rafter for the purlins and has a deep web made with a 12 x 5/16-in. plate and two 3½ x 2½ x 5/16-in. angles. The remaining members of the truss are made with pairs of small angles, back to back with the connection plates riveted between vertical flanges.

The center span transverse roof trusses are 45 ft. long, 10 ft. 11¾ in. deep at the ends and 12 ft. 4⅝ in. deep over all in the center and are made to correspond with the side trusses. All the trusses are riveted up complete at the bridge shops and were shipped on lighters to the pier site. The heaviest trusses weighed 3,000 lb. each and were quickly handled by the two booms of the light traveler which erected all the members of the structure, at a rate of as many as nine 15-ft. panels daily, the whole 600-ton structure being erected in two weeks. All field connections were bolted, no field rivets being driven.

The shed was designed and constructed under the direction of Mr. E. P. Goodrich, chief engineer of the Bush Co. Messrs. Post & McCord were the contractors.


Z
Z
A
B
8'-1½"
12'-4⅝"
46'-6"
22'-6"
16'-4"
18'-3"
17'-6"
Part of roof plan.
49'-2"
45'-0"
49'-2"
Part elevation Z-Z
Connection for longitudinal truss.
Connection for transverse truss to side column
Connection for transverse truss to intermediate column
Connection for transverse truss to longitudinal truss

Steel Shed of Pier Seven, South Brooklyn.

Power Gas is best made from small anthracite pea or gas coke, according to E. A. Dowson, an English gas power expert. He claims the use of bituminous coal is successful only in the Mond process and then only in large installations, owing to difficulties in cleaning.

Sewage Purification at the Eastern Indiana Hospital for the Insane.

Among the small sewage disposal works in the Central States, that built about two years ago at the Eastern Indiana Hospital for the Insane has been attracting considerable attention lately, and the following notes concerning it are accordingly reproduced from a paper read before the Indiana Engineering Society by Prof. R. L. Sackett, of Richmond. There are about 800 people at this hospital, and the water consumption is about 80,000 gal. daily. The sewage was formerly discharged into a stream 1,500 ft. distant, having a very small dry-weather flow. As a result the presence of the sewage could be observed for a distance of two miles downstream by the milky color of the water, and there was a fungus growth on the stones in the stream bed.

It was accordingly determined to put in sewage treatment works, although the presence of considerable quantities of disinfectant in the sewage were a possible obstacle to satisfactory operations. The old 18-in. outfall sewer was tapped near the buildings. In the manhole an emergency overflow was constructed so that an extraordinary storm could not choke the intercepting sewer. The latter consisted of a 10-in. line of vitrified pipe 1,100 ft. long, and 435 ft. of 10-in. water pipe, laid in an inverted siphon, in order to pass under a road and a railway.

The sewage is treated in a septic tank and on filters. The sewage enters the tank house through a goose neck and is discharged into a grit chamber, from which it flows into the septic tank proper. Here it stands at a depth of 6 to 8 ft. and for a period which seems to give the best septic action, as determined by periodic analysis. The structure, which is 67 ft. long, 20 ft. wide and 10 ft. high, is built of Portland cement concrete mixed in the proportions of one of cement to seven of an excellent quality of bank sand and gravel. In order to render the walls waterproof a coat of 1 to 1 cement mortar was troweled over the interior surface, which was exposed to water pressure. Over this a wash coat of neat cement was brushed on for finish. There is no seepage. The reinforcement consisted of the use of liberal quantities of wire rope three-fourths of an inch in diameter laid in the outer third of the wall at all corners and into all cross walls.

Various valves are provided, by which the chambers are cleaned and the sludge discharged on the surface of the ground for irrigation purposes. The structure, excepting the slate roof, is of concrete.

An 8-ft. weir leads from the tank to the dosing chamber holding from 4,000 to 6,000 gallons, depending upon the depth. This quantity is discharged automatically, at regular intervals of about thirty minutes, when the dose is 4,000 gal. The apparatus manufactured by Mr. W. S. Shields, of Chicago, operates four 12-in. valves leading to sewer pipe lines which conduct the sewage to the four filter beds. These valves are mechanically operated in turn by compressed air, the air being confined in a dome under water pressure. This apparatus was described in The Engineering Record of Dec. 14, 1901.

From the dosing chamber the effluent passes to the four filter beds, each of which is 100 ft. square. To each bed there are three cypress troughs with side openings, which distribute the sewage over the bed. The sewage as it goes on the beds shows only a slight milkiness in color, and the solids are not visible to the naked eye, except on close examination. The ground was graded to proper form, and a grillage of farm tile was laid, leading to a 12-in. trunk, which discharges into the creek about 150 ft. distant. On the tile a layer of coarse gravel was placed, obtained by screening a portion of the top material. Three feet of bank gravel, practically unscreened, but very uniform in quality, completed the filters. A concrete wall surrounds the whole, and gravel walks divide the area into four equal beds.

No odor was noticeable from any part of the plant up to the time Prof. Sackett read his paper. Chemical analyses of the raw sewage as it enters the plant and of the effluent from the filters gave the following results, in parts per million:

	Sewage.	Effluent.
Free and saline ammonia	23.40	17.50
Albuminoid ammonia	6.40	1.00
Total solids	580.	390.00
Residue on ignition	230.	390.
Organic solids	350.	180.
Oxygen consumed in 15 minutes	10.	2.
Oxygen consumed in four hours	18.80	3.

Bacteriological analyses show over one million bacteria per cubic centimeter in raw sewage, 40,000 in effluent from septic tank and about 20,000 in the filtrate. No plant life grew either near the outlet or at any point in the stream below, which would indicate the presence of sewage. When 5° below zero, Fahr., the temperature of the sewage thawed the frozen ground slowly, and at no time was the operation interfered with by freezing, even when the temperature was 20° below zero.

Besides the method of purification above outlined, a plan for land treatment of sewage was also devised and constructed. It was not intended that sewage irrigation would replace or supplement the septic tank except as it might be profitable to fertilize a garden tract of about twenty acres near the plant. The topography is such that the sludge in the septic tank can be flushed out through a pipe line on to the surface of a field in a diluted form, so that it will spread properly.

Defective Sewerage was the subject of an action brought by various property holders against the town of Woodbridge, N. J. The New Jersey Supreme Court has decided, 56 Atl. Rep., 141, that a public corporation which has constructed a public sewer is not answerable in damages to a property owner who has connected his cellar with the sewer, merely because, for lack of sufficient fall and capacity in the latter, the sewage backs up into the cellar through the connection so made. In devising a plan of public sewers, the court rules, the public authorities exercise a quasi-judicial function, and are not responsible to private property owners merely because, through errors of judgment, the plan which may have been adopted does not afford adequate drainage.

The Sierra Leone Government Railway.

The death this month of Sir William Shelford, K. C. M. G., followed soon after the completion of the last of his many engineering works of a pioneer character, the Sierra Leone Government Ry. As the consulting engineer to the Crown Agents for the Colonies he planned and directed this work for some years, but after the failure of his health two years ago he withdrew in favor of his son, Mr. Frederic Shelford, and the latter's partner, Sir Benjamin Baker. The railroad deserves notice not only as the crowning work of a long and useful life, but also as an example of construction for developing new countries where the receipts will probably fall below the fixed and operating charges of many years.

According to a detailed description of the road recently printed in "The Engineer" of London, it was the first to be started in British West Africa, and, although of a narrow gauge, is now longer than those upon the Gold Coast—168 miles—and at Lagos—125 miles—which are upon a 3-ft. 6-in. gauge. The narrow 2-ft. 6-in. gauge was adopted on the Sierra Leone Railway partly to reduce the cost of spanning the somewhat numerous and deep ravines encountered, and partly because the traffic was expected to require considerable fostering before it was likely to strain the capacity of a small gauge railway. The traffic has, however, developed considerably since the pacification of the country and the construction of the line, owing to the tapping of the large area of country containing vast natural fruit products, such as palm oil, kernels, rubber, shea butter, etc. The adoption of the narrow gauge was not effected by considerations of eventual junctions with other lines, as the Colony of Sierra Leone is enveloped by the enormous territories in Northwest Africa acknowledging the flag of France.

The railway starts from the capital, Freetown, long known as one of the finest natural harbors on the African coast, and proceeds to Songo Town, Rotifunk and Bo to Baiima. There is also a branch line 5¼ miles in length from Freetown to the adjacent hills overlooking the town and the sea. The greater part of this branch consists of a gradient of 1 in 23, and it is worked by specially designed adhesion locomotives. This branch line affords facilities for officials and others to sleep at an altitude of 1,000 ft. above the sea, instead of in the low-lying town as previously. The natural difficulties encountered included the ill-famed climate and the heavy rains which fall during the wet season. The average annual rainfall is about 175 in.

The heaviest portion of the line is from Freetown to Waterloo, a distance of 20 miles. In this distance there are altogether twelve viaducts. The survey for the most part was undertaken in the usual way with theodolite, chain and spirit level, preceded by a preliminary survey with miner's dial, compass and aneroid. The whole of the line was surveyed under the difficulties adherent to an undulating country clothed in tropical forest. The location of the first portion of the line was a matter of considerable difficulty. The maximum gradient adopted is 1 in 50, compensated for curvature. From Freetown to Songo Town the maximum gradient is 1 in 60. The minimum curve is 5 chains radius on the main line, with sharper curves of 118 ft. radius in station yards. The line has throughout been located as approximately a surface line, as heavy earthworks cause delay to a railway constructed upon the telescopic principle. The banks, rarely exceeding 15 ft. in height, have been made from side cuttings, and the excavation from cuttings has usually gone to spoil. The formation width for embankments is generally 12 ft., but a minimum of 9 ft. is adopted for rock banks on the straight. The minimum width of the road bed in cuttings is 8 ft., exclusive of side drains.

The first section to Songo Town, 32 miles, is laid with 28-lb. rails, but the rest of the line is laid with 30-lb. rails. The sleepers are of steel, except at points and crossings, and are spaced twelve to each 30-ft. rail on the straight road. Sleepers at joints are 2 ft., centre to centre. The weight of the steel sleepers is 35 lb. for the 28-lb. rail, and 40½ lb. for the 30-lb. rail. These sleepers are pressed in one piece, with lugs to receive the rails, and give a cant of 1 in 20. A key holds the rail in position, and the gauge may be varied by driving it either on the inside or the outside. Contrary to the experience in the other British West African Colonies, ample ballast has been found throughout, consisting of gravel and broken stone from the rock cuttings. Laterite, when broken and exposed, forms good ballast, and this has also been largely used. Owing to the good ballasting of the line, little trouble has been experienced with the track, in spite of the excessive rainfall. Upon a narrow-gauge railway in a tropical climate, ballasting becomes all-important in maintenance and working. Many of the cuttings are in laterite, and were constructed with vertical sides, effecting economy in earthworks, and have in most cases stood well.

The cost of effectively clearing the railway trace from forest growth is usually a heavy item in constructing a railway in tropical countries. Fortunately in Sierra Leone really heavy timber is not often met with, the bush usually taking the form of a low thorny scrub, or of palm trees, which do not run to the great diameters attained by the cotton tree commonly encountered in West Africa. The bush has been cleared throughout by hand; machinery not being considered practicable in a country where native labor is cheap and transport difficult. The clearing is 33 ft. on either side of the railway centre line, and more where the height of embankment or depth of cutting requires it, or where trees in the vicinity of the line, by falling, would obstruct the track. This railway, like other lines of penetration into an undeveloped country, was constructed "telescopically"; that is to say, the railway, as constructed, had to carry the plant and materials for its further extension.

Temporary bridges of native timber were made in advance, and the permanent bridges built at a later date. Arch culverts and abutments for open culverts are of concrete, and earthenware pipes have been used for the numerous small openings. On the extensions, steel pipe culverts, from 2 ft. 6 in. to 4 ft. in diameter, were largely used. The pipes are 6 ft. long, and are constructed of steel plate, with a socket joint for bolting to the next section. The chief advantage of these pipes is that they can be nested for shipment and permit of rapid construction.

Temporary bridges of native timber were constructed on the extension beyond Rotifunk. These were built to last for three years, if necessary, but for convenience most of them have been replaced in two years by bridges of concrete and steel. The permanent bridges are numerous and of various types. On the first section from Freetown to Songo, where the line skirts the foot of the Sierra Leone Mountains, they are chiefly steel viaducts across the deep gullies between the spurs of the range. The highest viaducts are between 70 and 90 ft. above ground level, and are constructed of steelwork with concrete foundations. The trestles are built on angle steel, with a batter in cross section of 1 in 6 and parallel in elevation, with a panel depth of 16 ft. The width of the trestle, and, consequently, the span of the girder over the trestle, is 18 ft. The spans between trestles are 32 ft. The girders are of the lattice deck type. The viaducts are all built on similar lines, but vary in their heights and in the span lengths between trestles, to suit the particular site.

The stations are at an average distance apart of eight miles. At Rotifunk and Bo, the principal up-country stations, considerable siding accommodation is provided, amounting in either case to nearly one mile. Both these stations have engine and carriage sheds, goods sheds and general stores. The average accommodation at intermediate stations consists of a station building and a platform, water tank and pumps, with a loop averaging 600 to 700 ft., and a dead-end siding of 200 ft. The main workshops and depot are at Clines Town, 1¾ miles from Freetown, no suitable ground being available at the terminus. The station buildings are placed on the platforms at a standard distance of 30 ft. from the track. These buildings consist of timber supported on concrete piers, except on the first section to Songo Town, where they are built of rubble masonry.

The following are the particulars of the main line locomotives, which have six wheels coupled with a leading and trailing pony: Cylinders, 10¾ by 15 in.; diameter of coupled wheels, 2 ft. 4 in.; heating surface, 381 sq. ft.; grate area, 6¼ sq. ft.; water capacity, 440 gal.; fuel capacity, 29 cu. ft.; working pressure, 160 lb. These engines have outside frames, so that the fire-box is not cramped and can be taken down for repairs in the usual way. The two remaining classes are six-wheeled engines, with all wheels coupled. The smaller of these has been chiefly used on construction, and the larger for traffic on the mountain railway. All engines are fitted with double spark arresters, and Walschaert valve gear has been used throughout.

The carriage stock consists of a dining and sleeping car for Government use, composite, second and third-class carriages, and brake mail vans. The composites seat 12 first-class and 16 second-class; the second-class seat 40, and the third-class 41. The length over headstocks of the composites and second-class is 37 ft., and of the third-class 31 ft. The whole of the carriages and wagons are of the bogie type. The first and second-class cars are constructed throughout of teak, and have a double roof and have platforms and steps at either end. Sunshades are provided for the entire length. Brakes, worked by hand from either end, are fitted. The wagon stock consists of open and high-sided wagons, 22 ft. 3½ in. over headstocks, covered goods, cattle trucks, flat wagons having a length of 31 ft., and brake vans, and most of the wagon stock.

The construction has been carried out by the Colonial Government. The engineering staff has been numerous and constantly changing on account of the necessity of liberal leave allowance. The chief resident engineer at first was Mr. W. Bradford and later Mr. P. Hayton.

A Material Contract of interest to both engineers and supply men was recently interpreted by the Maryland Court of Appeals in the case of National Building Supply Co. v. Mayor of Baltimore, 59 Atl. Rep. 726. An advertisement for bids to furnish the city with cement for a year gave "an approximate estimate of quantities required." The specifications stated that these approximate quantities were only to guide the bidders and did not bind the bidders as to the amount which would be ordered. A contract subsequently entered into with a bidder bound the latter to furnish all the cement which might be required during the year and bound the city to pay the sum named for all cement furnished and accepted. The court rules that under such a contract the city was entitled to all the cement it required at the price specified in the bid, and was not bound to pay the market price for cement ordered in excess of the "approximate quantity" specified in the proposal advertisements.

The Spacing of Stringers on Railroad Bridges.

At the recent convention of the Association of Railway Superintendents of Bridges and Buildings, Mr. J. P. Snow, bridge engineer of the Boston & Maine R. R., contributed a discussion on stringer spacing, in which he expressed a preference for main stringers 5 ft. center to center with side stringers 10 ft. center to center. The Boston & Maine standard ties are 12 ft. long, and any other arrangement of stringers does not give satisfactory support. With this spacing it is possible to use ties 7 in. deep by 8 in. wide. These are notched to 6½ in., which is enough to receive the spikes. The legitimate function of a tie is to hold the rail to gauge and line, it ought not to be asked to act as a beam to assist the iron floor of a bridge, which is what it is required to do if the stringers are spaced wider than 5 ft. on centers.

The side stringers are about one-half the strength of the main stringers so that they will safely carry the trains if off the rails. Their spacing is such that the ties overhang enough at each end to bring the guard timber bolts clear of the iron, but not enough so that the tie can break off or tip up if a wheel is on the end of it. If the main stringers are spaced more than 5 ft. apart, larger ties than those above described are needed; they must act as beams, and, as the maximum bending moment obtains under the rail where the tie is subject to injury by the spikes and cutting by the rails, they must be renewed at shorter intervals than if they act simply to support the rail directly over the stringers.

The side stringers add to the rigidity of the floor and their cost is partly recovered by the smaller size and longer life of the ties.

In the case of deck plate girder bridges the girders are set 9 ft. on centers and cross floorbeams are put in with stringers 5 ft. on centers, the tops of the stringers being flush with the tops of the girders, thereby giving four supports to the ties. These girders, up to 65 ft. long, are shipped riveted up complete; and they are more easily put in place than single girders. The additional cost of the floor is not so much as would be thought at first glance, as the floorbeams constitute a large part of the bracing. The extra cost of the floor is equal approximately to two suits of ties.

By this construction the top flanges of the girders are relieved from the direct action of the wheel loads and are left to their legitimate function of compression only. Many old plate girders show distress by the top angles working on the web from the pounding of the wheels. It is, in fact, the only way in which Mr. Snow has ever known a plate girder to fail. The above construction remedies this trouble and should be given more consideration than it has heretofore received.

The Thermo-Electric Thermometer has been investigated by Mr. A. de Forest Palmer, Jr., who gives the results of his work in the "Physical Review" for August. He found that under favorable conditions temperatures between 0° and 200° Cent. can be somewhat more accurately determined with a properly constructed and carefully calibrated mercury thermometer than by the thermo-electric method. But the mercury instrument requires very careful handling and gives reliable results only when suitable corrections are applied to its indications. In many cases it is very difficult, if not impossible, to determine these corrections with sufficient accuracy to obtain the highest precision. In such cases, he states, the thermo-element is quite as accurate and often much more convenient than the mercury thermometer.

Book Notes.

A most interesting report of a typhoid fever epidemic at Palo Alto, Cal., has been prepared by Prof. J. C. L. Fish and published by the Palo Alto Board of Health. It is important because it gives a record of the fever cases as well as the deaths from the disease, and is instructive as an account of efficient and thorough Board of Health practice. The epidemic was caused by the use of a contaminated water supply at a dairy. There were 236 cases and 12 deaths, the total population being about 3,500.

A year ago Mr. C. P. Paulding brought out a volume on the condensation of steam in piping, which has met with a decidedly favorable reception. It was based on Péclet's "Traité de la Chaleur," which has furnished the basic information for another book by the same author entitled "The Transmission of Heat Through Cold-Storage Insulation." In its 41 pages radiation, air contact and conduction are explained, and various useful tables from Péclet, Starr, Jude and Gossin, and other authors are reproduced. Formulas for the transmission of heat through walls of different types, floors and the coverings of brine pipes are deduced, and some experimental results confirming their general accuracy are presented. The book will prove useful to those who do not have access to the voluminous information on the subject in the German language. (New York, D. Van Nostrand Co., cloth, $1.00.)

One of the most valuable books of tables and rules relating to marine engines and boilers is that compiled by Dr. G. Bauer primarily for the use of his staff in the great Vulcan shipyards at Stettin. It is confined to the best German practice and is a book for everyday use. Fortunately for marine engineers of America and Great Britain, a translation of it has been made by Messrs. E. M. and S. Bryan Donkin and Leslie S. Robertson and published under the title, "Marine Engines and Boilers." It is thoroughly comprehensive, so comprehensive in fact that a statement of its contents would be merely a catalogue of the power equipment of a ship. The author's commanding position as a marine engineer and the high standing of the translators render criticism of the book superfluous. (London, Crosby, Lockwood & Son, 25s. net.)

About a year ago mention was made in this journal of the Schultze-Krell furnace-control apparatus. Numerous letters asking for further information lead to the belief that a book on the apparatus written by Mr. G. A. Schultze, of Berlin-Charlottenburg, will prove welcome. It bears the ambitious title, "Theorie und Praxis der Feuerungs-Kontrolle in Leichtverständlicher Darstellung," but it is actually a discussion of combustion in boiler furnaces and the use of the Orsat-Fuchs and the author's apparatus. Other apparatus is not described and no reference is made to platinum-resistance pyrometers, which are so much used in furnace investigation and control. Nobody can find fault with the fact that an instrument maker describes his own product, but somewhere about a book with such a title there should be a hint to the reader that other apparatus is made than that described. The book is a good one, with this limitation, and the apparatus and its use are equally important. (Berlin, A. Seydel, 8vo, 172 pp., paper.)

Practical Shipbuilding. By A. Campbell Holms. London and New York, Longmans, Green & Co.; 1 Vol. 8vo text, 600 pp., and 1 Vol. 4to, plates; 48s. net.

This ambitious work is very different from most books on the subject, as it is free from the mathematical analyses which are usually given in such works, and is confined to a description of the way merchant ships are built in British yards. The author's experience as one of the surveyors to Lloyd's Registry has given him a knowledge of the details favored by different builders, and this makes his book more comprehensive than if it were confined to the favorite practice of any one establishment. A great deal of ship design to-day is based on rules and precedents, and the book will be of value in any drafting room on account of its explanation of the merits of the different rules and systems of construction. A large part of the information every competent naval architect is supposed to have at his finger ends, but the manner in which the various topics are stated is so good that it is not unlikely many designers who will find little really new in the book will be glad to have such a well-digested and arranged statement of the principles and practice of good ship construction.

The description of the various types of merchant vessels is quite elaborate and accompanied by an explanation of the conditions which led to their development. The illustrations begin with the earliest steam vessels and furnish a good pictorial review of the progress in this branch of industry. The details of a vessel, keel, keelson, frames, plates, bottoms and other parts, are discussed critically, and there are chapters on special problems that arise in providing for machinery, attaching rudders and propeller brackets and laying out bulwarks, steering gear, pumping equipment, masts and the other parts of a ship. The methods used in the drawing room and mould loft are explained, the tools employed in ship building are described, and there is a chapter on launching.

A portion of the book that deserves special mention is the history of Lloyd's Registry and the explanation of its work. After reading Mr. Holms' defense of its rules, the usual criticism that the organization is a check on progress in British naval architecture loses much of its force.

Sir Henry Bessemer, F.R.S. An Autobiography, with a Concluding Chapter. London, Engineering; cloth, 4to, 381 pp., many illustrations.

Beyond question Bessemer was one of the great men of the last century. He was more than an inventor of great improvements. His fine presence, gift of eloquence, pertinacity and business acumen combined to give him a position in history which nobody who does one thing only can hope to achieve. His vigorous personality made him enemies, but he had little difficulty in surmounting all obstacles they put in his path or in refuting attacks on the importance of his inventions. The remarkable thing about his career is that he accomplished so much with so few advantages. He had no technical education and only a mere smattering of scientific knowledge. On the other hand he had abundant means, an extraordinarily active and logical mind, and colossal self-confidence. He cared nothing for the fact that he had no information on a subject he took up; in fact, he was rather pleased when this was the case, as the following quotation shows: "How often it has occurred to me, and how often have I expressed the opinion that in this particular competition, as in many other previous cases, I had an immense advantage over many others in dealing with the problem under consideration, inasmuch as I had no fixed ideas derived from long-established practice to control and bias my mind, and did not suffer from the too general belief that whatever is is right."

Bessemer was a born inventor. He began as a boy, and some of the most interesting portions of his book relate to these early improvements, a number of which were fairly profitable. The first which brought him a large income was the invention of bronze powders, which he was led to make by his insatiable curiosity concerning anything that attracted his attention. He happened to buy some "gold powder" for his sister, who was an artist of high talents. An examination of the powder showed it to be merely brass, although he had to pay 7s. an ounce for it. This induced him to undertake the construction of novel machinery for producing the powder, which is fully described in the book, although it long remained a secret. Another invention was n open-hearth furnace for making glass, which he built in 1847, and another was a method of making plate glass by pouring it in a continuous stream between rolls. The patent for this latter process was sold for £6,000.

The invention of the Bessemer steel process overshadowed everything else he accomplished, and the book gives a full account of it, step by step. It has been the subject of many controversies, some of them very bitter. Much of the bitterness was caused by Bessemer himself, who exercised little moderation in his statements regarding those who opposed him. This is shown in some of his statements in this autobiography, and in places, as in his references to Mushet's work, he manifestly fails to make out a good case for himself. It is fortunate for the future, however, that Bessemer exposes his weaknesses as well as his great qualities in this autobiography. He tells his own story so well that the reader has no difficulty in appreciating his unusual characteristics.

Letters to the Editor.

The Capitol Power and Lighting Station Competition.

Sir: In your editorial of Oct. 21 on the competition for the heating and lighting plant for the legislative buildings at Washington, you state: "A number of contractors, in furnishing without compensation professional services in the shape of plans in the hope of getting the work, have largely increased their cost of doing business and reduced their legitimate profits, since competitive schemes are likely to be cut down to the lowest possible limit in order to keep the bids down." Theoretically, this is probably correct, but actually it falls so far short of the real condition that we trust you will permit us to comment on it.

At the present time there are very few architects or engineers who make working drawings for heating work. In this part of the country there are none, while in New York there are not many. We have never had an opportunity of bidding on plans prepared by Mr. Wolff, but understand that they are no more working drawings than are the bridge plans turned out by a consulting engineer. If Mr. Wolff does not prepare such plans it is not likely that others will do so, although there must be a great difference between his drawings and the hopelessly confused and impracticable schemes that have occasionally been sent us by so-called experts.

The result of this condition has been the development of good designing departments by all contractors for important work. Although we make no claim to be a large company, in fact, there is not enough work for such a concern in this section, we have several graduates of technical schools as squad chiefs in our own department and require these men to keep posted on American and German heating and ventilating work so far as it is described in technical papers. We have never lost an opportunity to test our plants and believe that our private data of the resistance of pipe and fittings to the flow of steam and hot water, conductivity and radiation of walls and partitions, and such subjects are far more reliable than anything now in print. We have spent much time in preparing standard drawings and details. Consequently, we feel confident that we are able to turn out plans for heating and ventilating most classes of buildings at a small fraction of the cost of no more reliable work by consulting engineers. We greatly prefer to work from engineers' plans, as we are thereby merely contractors, but as a matter of fact the cost of doing all the designing is so little more than the cost of preparing the working drawings from the plans usually given us by engineers to follow that the difference is not worth mentioning. Our reason for preferring to act as contractors only is that we believe all the designing should be done by the architect or specialists working with him, and that the contractors should be responsible for nothing but the execution of the plans and specifications. If, however, we are to be responsible for results we prefer to design the plant ourselves, and this consideration brings us to the pith of the Washington competition.

What the Congressional committee desires is a central station which will give the desired service economically and will not cost more than the estimates. Government experience lately has been so unsatisfactory that it is natural the committee should desire to eliminate the architect and engineer and do business solely with financially responsible engineering contractors, who will make and live up to guarantees. We believe the Government would be as well off if the plant were designed by a competent consulting engineer as by competent engineering contractor. The latter could prepare the plans at considerably less expense than the former, and there would not be any tedious wrangling by the makers of apparatus who were unable to bid under the consulting engineer's specifications, generally drawn to favor his pet engines, boilers, generators and other equipment. The practice is not to be commended, however, for it too often places the decision concerning the merits of the competitive plans in the hands of incompetent judges. In most cases it is unquestionably better from every point of view to employ an engineer to prepare plans on which all bids will be based.

Engineering Contractors.

Bedding the Main Pedestals of the Quebec Bridge.

Sir: The imperfect description of the method used for bedding the main pedestals of the Quebec bridge and the discussion thereon by a number of engineers impel me to give a fuller description and explain my reasons for giving preference to this method.

Extracts from my instructions:

"To be bedded on two thicknesses of canvass, made of No. 1 cotton duck . . . Each canvass shall be painted on both sides with a red lead paint, made from pure linseed oil and red lead only. The paint to be made as thick as can be worked with a hard brush, and to be liberally used. The canvass must be dry so as to readily absorb the paint. After the first coat has become tough enough to allow handling the canvass, a second thick coat should be given. The canvass should be painted only sufficient time in advance of its being put in place for the paint to become tough enough to handle but not get hard. As each sheet is placed in final position its top surface should be given another coat of fresh paint. Nothing but these painted canvasses must be placed between the pedestals and the masonry. It is desired that the paint shall be sufficiently abundant to be squeezed into all the crevices and forced out around the edges, when the load is applied, so that there may be a perfect contact and a perfect sealing between the masonry and the metal work."

For setting the two south pedestals, now in place, nearly one ton of red lead was used. A large part of this will be squeezed out as the load is applied, but there will be no vacancies.

For ordinary pedestals, where the pressure per square foot is moderate, they can be safely set on well dressed masonry or a thin layer of cement mortar. When, however, the magnitude of the structure demands that we use heavy pressures, it is important that we so bed the pedestals as to get the best possible contact and uniform distribution of the load. It would be impracticable to bed the Quebec pedestals upon cement mortar, owing to the great weight and a bearing surface 18 by 20 ft.

Over a third of a century ago (St. Louis bridge) extensive and elaborate experiments were made to find the best manner of bedding stone, brick and concrete specimens for testing. The best results were obtained when the packing was of a fibrous character, soft wood, leather, blotting paper, etc. With such packing, blotting paper being found the most satisfactory and convenient material, the cracking of the specimens did not occur until the materials were taxed nearly to their full capacity. These tests have since been verified by other experimenters. Sheet lead was found to be the worst possible material, as it was shown to be squeezed into the stone as fine wedges.

I set the skewbacks of the Washington Arch bridge, which have a maximum pressure of about 43,000 lb. per square foot, on several layers of asphalted wool felt, with good results.

Against the use of sheet lead for any such purpose, I have always had a prejudice. First, it has a tendency to creep, due to its ability to expand under pressure, but not to contract again owing to its low tensile strength. Second, it cannot accommodate itself to an unequal bearing, until excessively high pressures occur at local points, for lead does not flow until the pressure per square inch is somewhere about four to five tons.

Theodore Cooper.

The Atlanta Garbage Destructor.

The garbage cremator at Atlanta, Ga., was highly praised by Mr. Howard G. Bayles in a paper read before the American Society of Municipal Improvements. It is a Decarie plant of two furnaces, and is rated at 200 tons in 24 hours. The material burned is mixed refuse, that is, kitchen, garbage, rubbish, boxes, barrels, and, occasionally, a little manure. The bulk of the manure, the night-soil, the street sweepings and ashes are not burned, but are carted out of the city. Up to the first of July no fuel other than the coal in the fume cremator was used, the waste material furnishing all the heat necessary for its own combustion. During July it was found necessary to use cord wood on the lower grate, about 2½ cords per day. This condition, which extended decreasingly through August, was due to the melon season. During the months that no fuel was necessary in the furnace the cost of operation was about 14 cents per ton of refuse consumed. During July it was 30 cents, and for August it was not expected to average 20. This would make the average for the year only 16 cents per ton. The repair item is negligible. The only thing about the plant that has so far needed attention has been the concrete floor that is immediately over the furnace. There seems to be no other part of the furnace that could wear out or give way, owing to the care taken in adapting every part to its function. Atlanta expects to duplicate this incinerator in another part of the city within a year.

CURRENT NEWS SUPPLEMENT

OCTOBER 28, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Next meeting, Nov. 1, paper on theory of building frameworks.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association.. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association.. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York. Annual meeting, Dec. 4-5; 12 West 31st St., New York.

National Association of Manufacturers of Sand-Lime Products. Secretary, H. A. Duerr, Wilmington, Del. Next meeting, Dec. 5-7, Detroit.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia, Pa.

WELDED FLANGES FOR WROUGHT PIPE.

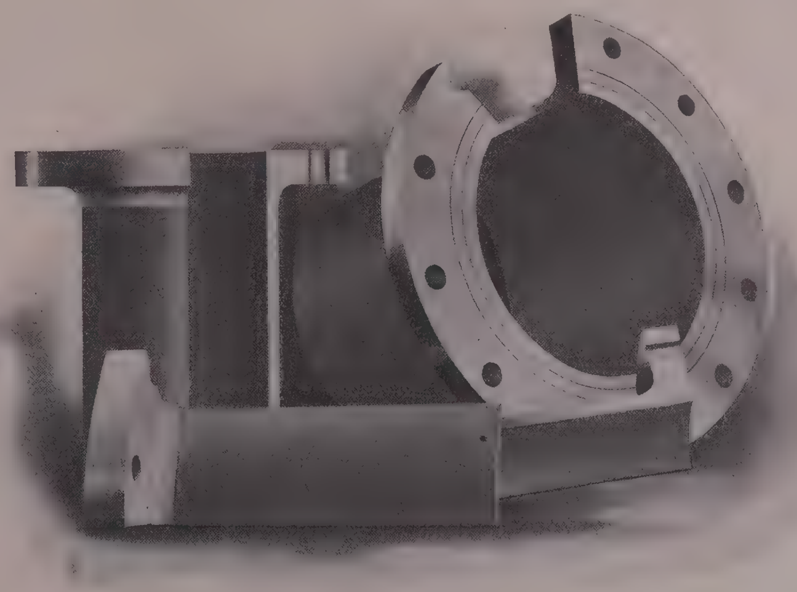
Engineers who have to employ steam, air, gas and water piping where leakage must be prevented, high pressure cared for, expansion provided for by getting a very strong joint, and where variations in pressure may occur, will be glad to know that the Ball & Wood Co. has built and equipped a shop at Elizabeth, N. J., where it is making up wrought pipe from 2 to 30-in., with flanges welded on, to meet all the foregoing and other severe requirements. The serious objection against welded flanges heretofore has been the slowness of delivering them, but the equipment installed by this concern will remedy this condition. The flange welding department is under the direction of Mr. O. M. Jones, for a long time connected with the National Tube Co. Engineers appreciate that this superior class of work is more costly to produce than some other types of joints, and many of those who have not used it have the impression that it is beyond their reach, but on submitting blue prints and specifications of piping for quotations, they will probably find this opinion mistaken.

The flange and pipe for such a joint are welded just as the seam in the pipe is welded. There is no injury done to the metal, any more than in welding the seam, and the special equipment and methods of the Elizabeth shops are such that only perfect welding and material are furnished. Special attention is given to the most minute details, such, for instance, as using a blacksmith's standard coke fire for heating, thereby obtaining a slow even heat. The fact that lap-welded pipe is so largely used ought, in itself, to convince the engineer of the entire practicability of welded flanges, even without all the refinements introduced at the Ball & Wood shop.

The flanges are forged from the same grade of metal that is used in the pipe. The pipe is carefully tested and then specially prepared to receive the rough flange. This is placed on the pipe close to the end, and the flange and pipe are heated. The welding is done by machinery designed for the purpose, but the process is practically the same as that employed by the pipe makers in welding the seams or lap, as before stated. When the process is completed the flanges are faced off and the back and edge turned down. Unless otherwise specified all flanges and bolt holes conform to the standard for extra heavy flanges adopted on June 28, 1901, at a meeting of the valve and fittings makers of the United States.

Special flanges of other dimensions can be supplied if desired, and they can be furnished with plain, tongue-and-groove, and male and female taces, or with raised faces and with smooth lathe finish for grinding to a ground joint. After completion each piece of pipe is tested under hydraulic pressure.

The advantages of welded flanges have never been shown to better advantage than by the use of them by the New York Steam Company for their distributing mains, and for the service connections. The streets of lower Manhattan Island contain a tangle of pipes and conduits which make it wholly impracticable in most cases to put in a straight run of pipe for service connections from the mains into the buildings. Formerly the many bends were made with fittings. Owing to the settlement of the earth and the frequent digging up of the streets for one purpose or another, the service pipes are subjected to considerable disturbance, and the old methods of connecting them could not be kept steam-tight. In fact, the leakage of steam from these pipes became a byword among local engineers. Since welded flanges have been on the market there has been no difficulty in making joints which keep tight. The service pipe gang is provided with a portable bending outfit and the pipe is fitted on the spot. Then the bolts are screwed up and the work is done.



SECTIONS OF WELDED FLANGES AND PIPES.

In connection with flange welding the Ball & Wood shop is equipped for pipe bending. The demand for expansion loops, offsets and other special work is constantly increasing, because all changes in direction made with fittings add joints to a pipe line, and joints should be avoided as much as possible, even at somewhat increased cost. In laying out bends there should be a short straight length of pipe adjoining each flange, before the curve begins. On pipe less than 4 in. in diameter this straight section should be at least 1½ diameters in length, and on larger pipe at least one diameter. Wherever practicable it is well to have the straight length at least 2 diameters. To assist the engineer in laying out such work the company has prepared the accompanying table giving the greatest and least radii to which pipe of standard thickness can be bent, and also the radii which it is best to use, if possible. If the radius must be reduced below the minimum given in the table, the thickness of the pipe should be increased.

Table of Radii for Pipe Bends

Pipe size. Inches.	Minimum radius. Inches.	Maximum radius. Inches.	Advisable radius. Inches.
2½	10	25	15
3	12	30	18
3½	14	35	21
4	16	40	24
4½	18	45	27
5	20	50	30
6	24	60	36
7	28	70	42
8	32	80	48
9	36	90	54
10	40	100	60
11	44	110	66
12	48	120	72
14 O. D.	60	140	84
15 O. D.	68	145	90
16 O. D.	76	150	100
18 O. D.	90	165	125
20 O. D.	120	180	150
22 O. D.	132	198	165
24 O. D.	144	216	180

The company's shop was started up on July 15, and it has already furnished welded-flange pipe to the New York Steam Co., the Detroit Edison station, the power plant of the Long Island R. R., the Narragansett Electric Light Co. and the Rhode Island Co., at Providence, to mention only a few sales for important plants. It might also be added that about the strongest confirmation of the reliability of welded flanges is furnished by their use by the Otis Elevator Co. for the cylinders of high-pressure elevators. This service is far more severe than that to which any ordinary piping is subjected, for the test pressures run as high as 2,500 lbs. per square inch.

A trade publication that will interest a great many people is the "Souvenir" of the Shaw Block Co., of Chicago. It advances many novel ideas concerning the manufacture and uses of concrete blocks of a type designed by Mr. William Enfield Shaw, who is stated in the book to have planned the improvement of Pennsylvania Ave. in Washington and to have laid the first asphalt pavements in Chicago. The block is stated in the book to be equally useful in buildings, pavements, culverts, conduits, sea walls, dams and docks. Some idea of the new views with which the book is replete can be gained from the following quotation regarding engineers who employ limestone masonry: "In vain will they use a veneer of sand and cement to obviate the absorbent qualities of limestone; nature is not to be cheated with any such ingenious sophistry, for under the action of the elements—contraction and expansion—electro-absorbo-seip, a process like to chemosmosis would take place as in a native rock and the veneer would come off like the smiling mask of the calcitrant dissembler who says that 'it's just as good.' "

TRACTION MATTERS IN CHICAGO.

The situation as regards municipal ownership of street railways in Chicago has lately been considerably affected by the tentative proposals of the Chicago City Ry. Co., recently submitted to the Transportation Committee of the City Council. This communication contains the draft of an ordinance suggested as equitable by the company, its leading provisions being substantially the following:

Section I. Twenty-year franchise, providing that city may purchase at any time after three years.

Sec. 2. Company shall reconstruct tracks and roadbed.

Sec. 3. Company shall use overhead trolleys, except on Clark and State sts. and downtown loops, north of Polk st., where underground trolleys shall be used if found feasible after test on State st.

Sec. 7. All of company's feeder wires in central portion of city shall be laid underground and same rule shall apply to all feeders carrying over a thousand volts in all parts of city.

Sec. 11. New cars shall be of best kind, without running foot boards, well heated and equipped with two sets of brakes.

Sec. 12. Funeral cars, postal cars and cars for the carriage of parcels and packages may be operated by the company.

Sec. 13. Company may make bargain with city for sweeping and cleaning entire width of streets occupied by company and for removing sweepings and garbage by night cars.

Secs. 17 and 18. Straight 5 cent fare for adults; children between 7 and 12 years of age to pay 3 cents. Universal transfers, except in the downtown district north of 12th st.

Sec. 20. Compensation fixed at following percentàges of gross receipts: First three years, annually 3 per cent.; next two years, annually 5 per cent.; ensuing ten years, annually 7 per cent.; last five years, annually 10 per cent.; general average, a fraction under 7 per cent. annually. Compensation is to be in lieu of all licenses and all franchise taxes, including taxes on capital stock.

Sec. 21. Company relieves city from onus of damage suits.

Sec. 22. Company before March 1 of every year shall make annual report of gross receipts and books shall be open to city controller.

Sec. 23. Forfeiture clause in case company fails to live up to provisions of this ordinance.

Sec. 24. City may intervene in case any suit it deems collusive is brought against the company to restrain it from carrying out the provisions of this ordinance.

Sec. 25. City Council may compel company to extend its lines at the rate of not more than three miles of double tracks annually, providing at least one hundred and fifty families live within one-quarter of a mile of the street along every mile of the proposed extension.

Sec. 26. City may at any time after not less than one or more than two years' notice to the company buy it out at the fair cash value for all real and personal property plus the fair cash value at that time of such of the company's present rights as may then still be unexpired, regardless of the present ordinance. The city and the company each shall appoint one appraiser of these rights, and those two appraisers shall select a third, who must not be a resident of this State. Should both fail to agree, the third appraiser must be selected by three judges, including the chief justice of the Supreme Court of Illinois and two judges of the United States Circuit Court. The decision of a majority of these appraisers shall be binding on both the city and the company.

Sec. 27. At the end of twenty years the city may buy or sell to another corporation the right to buy the company's lines for the appraised value at that time of the real and personal property without paying anything for "any franchise or license." Every right and privilege of the company of every kind will then cease.

Sec. 28. If after twenty years the city is willing to make a further grant to the company, the appraised cash value of the company's property at that time shall be taken as the value of company's investment, regardless of any stocks or bonds that may be then outstanding.

Sec. 29. Express waiver of all claims under ninety-nine-year act and other laws in return for a full twenty-year franchise. Provision withdrawing that waiver if city takes over lines before expiration of the desired twenty--year grant.

Sec. 30. Provision for referendum, requiring majority of all voting at next spring's elections to vote against ordinance in order to invalidate it.

It is not considered likely that such an ordinance will become law, at least during Mayor Dunne's term of office. Moreover, it is not likely that the possession of the streets can be obtained by the city until the expiration of the franchise periods for their occupation by the company. The right of eminent domain has never been recognized as applicable to achieve merely a change of ownership, and even were it possible to apply it the city is financially unable to pay the enormous expenses of securing the company's rights in this manner. Part of the railway property is also tied up in the hands of receivers appointed by the federal courts, which further complicates the situation.

THE GRAND TRUNK PACIFIC RAILWAY.

According to the official prospectus of the Grand Trunk Pacific Ry. Co., it is under agreements with the Canadian Government for the construction and operation of a railway from the Atlantic to the Pacific, wholly within Canadian territory, of an estimated mileage of main line of 3,600 miles; in addition to which there will be constructed several branch lines of importance, including one from the main line southerly about 220 miles to Fort William and Port Arthur, on Lake Superior; one from the main line southerly about 250 miles to North Bay or Gravenhurst, to make connection with the lines of the Grand Trunk Ry. Co., and one from the main line southerly to Montreal. Branch lines are proposed to Brandon, Regina, Prince Albert and Calgary, and to Dawson in the Yukon Territory.

The authorized capital stock of the company is $45,000,000, of which $20,000,000 may be issued as preferred. The Grand Trunk Ry. Co. of Canada is to acquire all of the common stock, in consideration for guarantees, etc., and must retain a majority holding during the term of the agreements with the government.

The eastern terminus of the railway will be at Moncton, New Brunswick, from which point the seaports of Halifax and St. John will be reached over the Intercolonial Railway, the distance to the first-named port being 183 miles and to the latter 89 miles. The western terminus will be in the vicinity of Port Simpson, on the Pacific Coast, immediately to the south of the boundary of Alaska.

For the purposes of construction, the projected line is divided into the Eastern Division, 1,800 miles, and the Western Division, 5,000 miles, the point of division being Winnipeg, Manitoba.

Eastern Division.—Commencing at Moncton, the line will take the most direct practicable route within the Province of Quebec, to the city of Quebec. At Chaudiere Junction, 5 miles above Quebec, the new line will cross the St. Lawrence River by a bridge now under construction by the Quebec Bridge Co. From Quebec, a route will be taken passing in the vicinity of Lake Abitibi and to the north of Lake Nepigon, to Winnipeg, an estimated distance of 1,800 miles from Moncton. The main line of this division will be built at the cost of the Canadian Government and leased to the company for a period of 50 years, and the branch lines will be built by the company. The Government has appointed four commissioners, under the name of "the Commissioners of the Transcontinental Railway," who will have charge of the construction of this portion of the main line in behalf of the Government.

The branches of this division will be constructed and owned by the company and a subsidy has been granted by the provincial government of Ontario, in aid of the construction of the Lake Superior branch to Fort William and Port Arthur, of $2,000 per mile cash and 6,000 acres of land per mile.

The branch from the main line to North Bay or Gravenhurst, will also be an important one, as forming the connection between the new transcontinental railway and the present Grand Trunk Railway System. The same may also be said of the projected branch from the main line of the Eastern Division to Montreal.

Western Division. — The Western Division is subdivided into the Prairie Section and the Mountain Section, the former extending from Winnipeg through Edmonton to the eastern foothills of the Rocky Mountains, a distance estimated at 1,100 miles, and the latter, being the section over the mountains to the Pacific Coast, a distance estimated at 700 miles. This division will be built at the cost of the company, the government aiding by guaranteeing first mortgage bonds of the company to the extent of $13,000 per mile on the Prairie Section, and for three-quarters of whatever the cost per mile may be of the Mountain Section, the Grand Trunk Ry. Co. of Canada, guaranteeing an issue of bonds of the Grand Trunk Pacific Co. to provide the remainder of the cost of construction. The company is to pay the interest on the bonds issued on the Prairie Section and guaranteed by the government, from the date of issue, but the government will pay the interest on the bonds guaranteed by it on the Mountain Section, for the first seven years after the completion of the line, with no recourse on the company for the interest so paid. Thereafter the company will pay the interest on the bonds guaranteed by the government.

Mistakes which have been made in earlier American railway construction in respect of heavy gradients and curvature, thereby entailing large capital expenditure in subsequent years, equivalent, as has been the case in some instances, to the cost of first construction, will be avoided in the case of the Grand Trunk Pacific by obtaining a grade not exceeding about 22 ft. to the mile, and in respect of the Mountain Section the surveys show that 52 ft. to the mile can be secured.

From surveys already made the cost of the railway is estimated, for the Prairie Section, to be from $20,000 to $25,000 per mile, for the Mountain Section from $50,000 to $60,000 per mile, and for the Eastern Division at $30,000 per mile, or a total cost for the entire main line of $123,500,000.

The officers of the Grand Trunk Pacific Ry. Co. are: Charles M. Hays, president; Frank W. Morse, vice-president and general manager; William Wainwright, second vice-president; Henry Philips, secretary; Frank Scott, treasurer; H. W. Walker, general auditor; B. B. Kelliher, chief engineer; H. A. Woods, assistant chief engineer. Headquarters, Montreal, Canada.

ROLLING LIFT BRIDGES FOR DOUBLE-TRACKING UNDERTAKINGS.

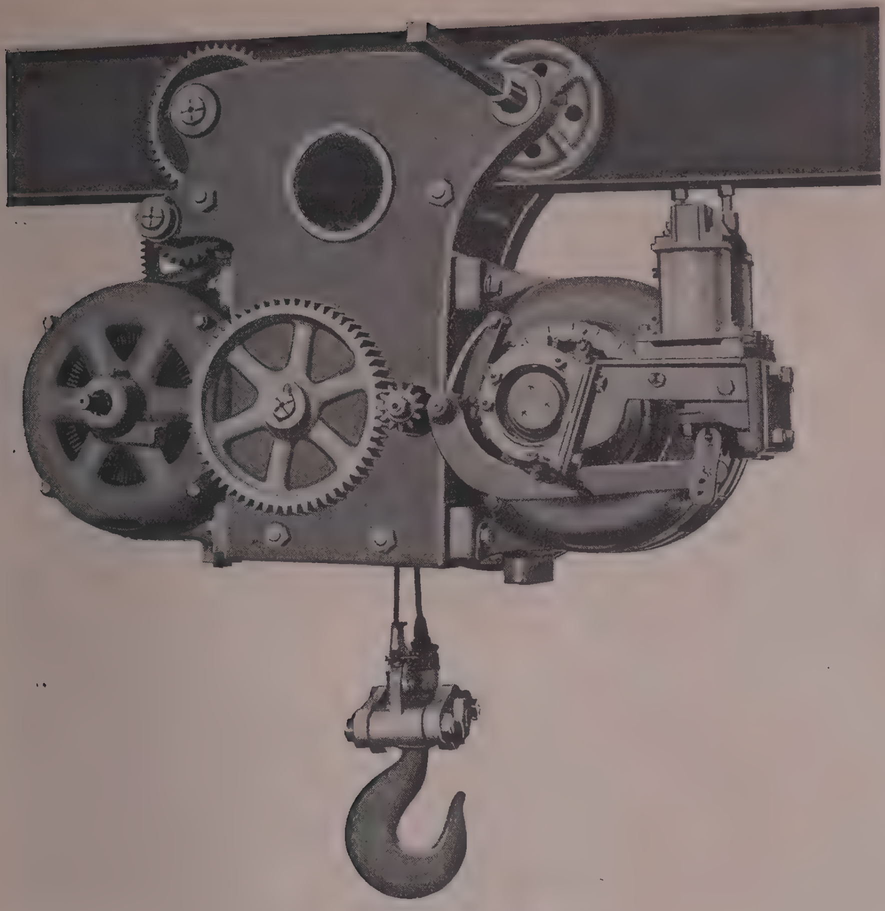
A leading tendency in railroad construction in the United States in the future will be to increase the number of parallel tracks instead of the construction of pioneer or competing single-track lines, which was the principal tendency in construction until lately. At the present time more than 200,000 miles of single-track railroad have been constructed, but the second, third, fourth and sixth tracks constructed amount to less than 20,000 miles. During the past ten years traffic has increased on some railroads so rapidly as first to require double tracks, then four tracks, and now in some cases, six tracks. These railroads are now very prominent, but their experience in developing increased traffic will be common in a large degree to all of the single-track railway lines of the United States. All of them will have to increase the number of their parallel tracks to accommodate their increasing traffic. It is safe to predict that the existing railroad traffic will be doubled in the next twelve years and that this ratio of increase will continue for decades to come.

A prominent feature connected with the handling of increasing traffic and the construction of the additional parallel tracks required is the extensive removal of single and double-track center-pier swing bridges and their replacement with bascule bridges. One of the inherent limitations of the center-pier swing bridge is the fact that it cannot be enlarged or widened to accommodate additional tracks. It must always be discarded and removed at a great loss, also deranging traffic, for if a new swing bridge were constructed alongside an existing swing bridge, it would be impossible to operate either of them, because they would interfere with each other. This difficulty is overcome by the modern Scherzer rolling life bridge, which can be constructed as a single-track structure and be enlarged to a double or multiple track structure at any time without interfering with the existing bridge or disturbing the existing traffic by simply adding the new bridges alongside of the existing structure.

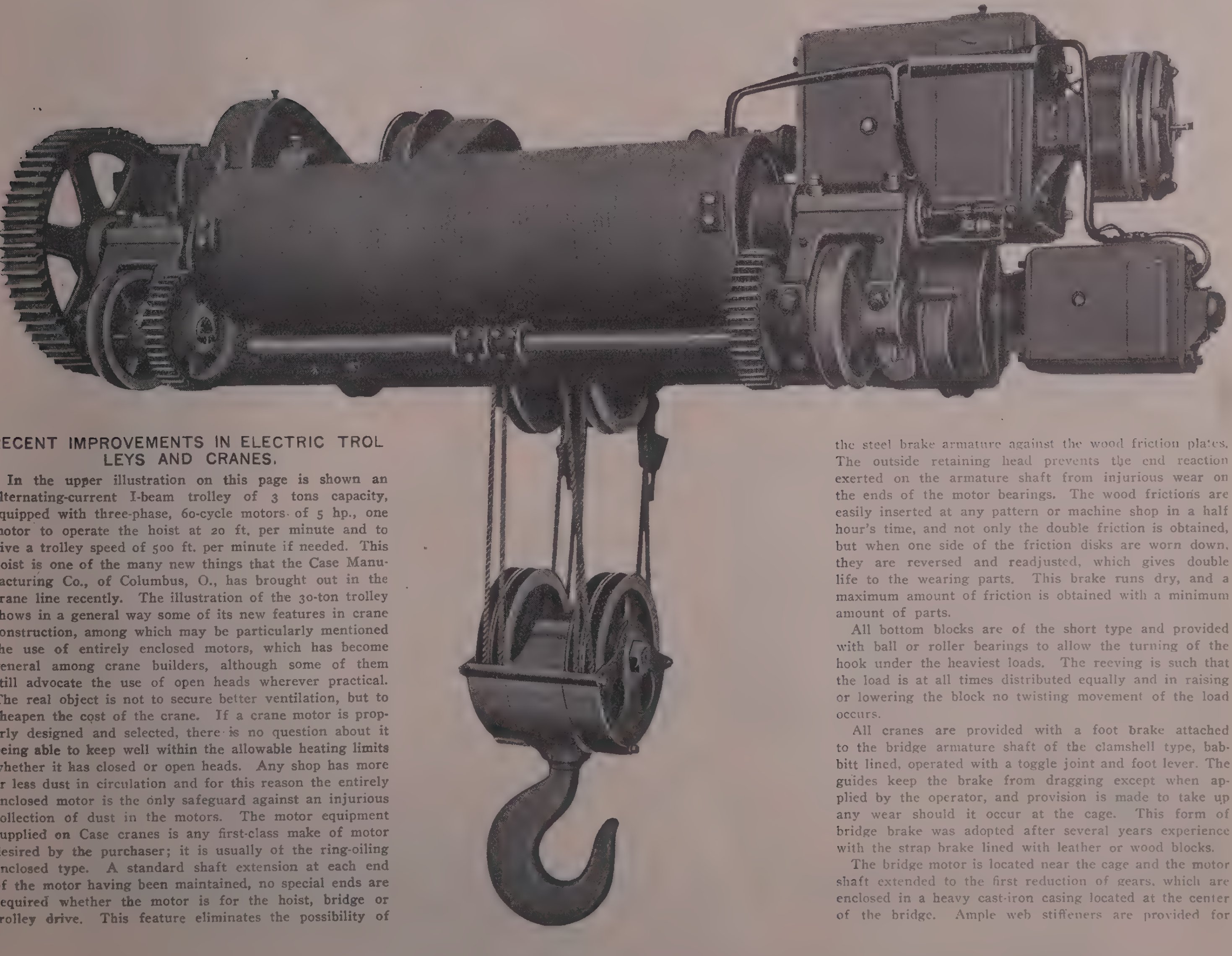
Some of the notable Scherzer bridges constructed and under construction to replace center-pier swing bridges in this movement to accommodate increased traffic and additional parallel tracks are: The four-track bridge for the Metropolitan Elevated Ry. Co., Chicago; the double-track bridge for the Chicago Terminal Transfer R. R. Co., at the entrance to the Grand Central Station, Chicago; the eight-track bridge at Chicago, used by the Pennsylvania lines west of Pittsburg, the Chicago Terminal Transfer R. R., the Chicago Junction R. R. and the Baltimore & Ohio R. R.; the single-track bridge used by the Big Four R. R. at Cleveland; the double-track bridge used by the Big Four R. R., the Lake Shore & Michigan Southern Ry. and the Erie R. R. at Cleveland; the double-track bridge used by the Newburgh & South Shore R. R., at Cleveland; the double-track bridge used by the Baltimore & Ohio R. R., Cleveland, replacing a single-track swing bridge; the two Scherzer briges used by the Central R. R. Co. of New Jersey, the Reading R. R. and the Baltimore & Ohio R. R. across Newark Bay, N. J.; the double-track bridge used by the Boston, Revere Beach & Lynn R. R.; the six-track bridge at the entrance to the South Terminal Station, Boston; the four-track bridge used by the New York, New Haven & Hartford R. R. Co., at Bridgeport, Conn., replacing a double-track swing bridge. There are now also under construction for the New Haven line four-track Scherzer bridges at Cos Cob, Westport, and over the Housatonic River, Conn., and over the Neponset River, Mass. A double-track bridge is under construction across the Connecticut River, to be enlarged subsequently to a four-track structure. Six-track Scherzer bridges are also to be constructed across the Bronx River and across the Hutchinson River, New York, replacing four-track swing bridges. A double-track bridge has been placed in service recently for the South Eastern & Chatham Ry. Co.., across the Swale River, England, and another is nearing completion across the Suir River, Ireland, for the Fishguard & Rosslare Rys. A three-track Scherzer bridge is under construction for the Dutch State Railways, Holland, and a double-track bridge is under construction for the Buenos Aires Great Southern Ry., across Riachuelo River, Buenos Aires, replacing a center-pier swing bridge.

The more than forty Scherzer bridges already constructed for the use of electric railway companies have nearly all been constructed as double-track and multiple-track structures. They can readily be enlarged at any future time to accommodate increasing traffic and additional tracks without disturbing the existing bridges or traffic.

The bascule bridge over Newtown Creek, between the Boroughs of Queens and Brooklyn, New York City, which has just been opened to traffic, is an excellent illustration of this type of structure and its advantages.



NEW ALTERNATING-CURRENT I-BEAM TROLLEY.



RECENT IMPROVEMENTS IN ELECTRIC TROLLEYS AND CRANES.

In the upper illustration on this page is shown an alternating-current I-beam trolley of 3 tons capacity, equipped with three-phase, 60-cycle motors of 5 hp., one motor to operate the hoist at 20 ft. per minute and to give a trolley speed of 500 ft. per minute if needed. This hoist is one of the many new things that the Case Manufacturing Co., of Columbus, O., has brought out in the crane line recently. The illustration of the 30-ton trolley shows in a general way some of its new features in crane construction, among which may be particularly mentioned the use of entirely enclosed motors, which has become general among crane builders, although some of them still advocate the use of open heads wherever practical. The real object is not to secure better ventilation, but to cheapen the cost of the crane. If a crane motor is properly designed and selected, there is no question about it being able to keep well within the allowable heating limits whether it has closed or open heads. Any shop has more or less dust in circulation and for this reason the entirely enclosed motor is the only safeguard against an injurious collection of dust in the motors. The motor equipment supplied on Case cranes is any first-class make of motor desired by the purchaser; it is usually of the ring-oiling enclosed type. A standard shaft extension at each end of the motor having been maintained, no special ends are required whether the motor is for the hoist, bridge or trolley drive. This feature eliminates the possibility of having to purchase spare armatures in multiple numbers on account of special ends. In the design of these machines, the usual factor of safety, has been largely increased in all the wearing parts, such as shafts, gears, pinions, brakes, etc., in order to add to the working life of the machine and secure additional protection against sudden shocks tending to cause a breakdown.

The preceding remarks relating to details should be supplemented by a reference to the general design. The hoisting mechanism is mounted on top of the trolley sides and arranged so that the motor, shafts, brakes, drum and drum gear may be removed individually without disturbing any other part of the mechanism. All gears are cut from special tough gear stock or steel, as desired. The trolley sides are of cast iron, very heavy and rigid and so ribbed as to transfer all strains properly, and are held in position by a heavy steel cross-girt. This girt is made very wide and when bolted to the sides forms a stiff frame which holds the working parts of the trolley in alignment and insures high efficiency. The trolley sides are bushed and provided with caps for the trolley-truck wheel axles. The caps are placed at such an angle that the wheels and axles may be readily removed without jacking up the trolley. The trolley-truck wheels are kept alike, for convenience in repairs, and the trolley-drive motor and gearing are very accessible. The gears, except the truck and drum gears, are enclosed in oil-tight casings, overhung gears and pinions are eliminated and low stresses are maintained.

The successful operation of a crane is due largely to the brakes, and the Case Co. has designed both the motor and load brakes with this point in view, as well as simplicity in construction in order to facilitate repairs. The Case load brake is a modified type of the old Weston or screw brake, revised to provide a double friction with the ratchet and other parts kept very large. In doing this the usual pressure per square inch has been reduced on the friction surfaces and a friction material is used which will not cut or bind or slip. These brakes are filled with sufficient grease at the factory to keep them in working order for months. The Case motor brake is of new design, attached to the motor head, and is of the magnetic spring type. The electric current releases the brake, and, when shut off, the springs concealed in pockets force the steel brake armature against the wood friction plates. The outside retaining head prevents the end reaction exerted on the armature shaft from injurious wear on the ends of the motor bearings. The wood frictions are easily inserted at any pattern or machine shop in a half hour's time, and not only the double friction is obtained, but when one side of the friction disks are worn down, they are reversed and readjusted, which gives double life to the wearing parts. This brake runs dry, and a maximum amount of friction is obtained with a minimum amount of parts.

All bottom blocks are of the short type and provided with ball or roller bearings to allow the turning of the hook under the heaviest loads. The reeving is such that the load is at all times distributed equally and in raising or lowering the block no twisting movement of the load occurs.

All cranes are provided with a foot brake attached to the bridge armature shaft of the clamshell type, babbitt lined, operated with a toggle joint and foot lever. The guides keep the brake from dragging except when applied by the operator, and provision is made to take up any wear should it occur at the cage. This form of bridge brake was adopted after several years experience with the strap brake lined with leather or wood blocks.

The bridge motor is located near the cage and the motor shaft extended to the first reduction of gears, which are enclosed in a heavy cast-iron casing located at the center of the bridge. Ample web stiffeners are provided for the girders which hold the bridge propelling machinery in place and eliminates the twisting tendency on the front girder. The bridge shaft brackets are located at close intervals and all bearings which are not removable are bronze bushed. All the bridge truck wheels are exactly alike. The bridge truck-wheel bearings are of the self-oiling M. C. B. type and may be removed without jacking up the crane, and after the bearings are worn to any extent all that is necessary is to take up the wear with liners.

Case controllers are provided with a blow-out coil and quick-break and roller-knife contacts. The limit switch is of Case design and entirely automatic, being of the circuit-breaker type and located in the cage. When the bottom block approaches the upper limit of run the contactor blows the circuit-breaker and opens the circuit until the controller is thrown to central or lowering position. When the hook is in this position it is only possible to lower, as any attempt to hoist will simply blow the circuit-breaker, which repeatedly replaces itself, being entirely automatic. The electrical equipment is made strictly in accordance with the underwriters' rules.

HEAVY ORDERS FOR RAILWAY EQUIPMENT

In its issue of Oct. 13, the "Railway Age" recorded orders for 460 passenger cars, 30,620 freight cars and 333 locomotives, and inquiries for additional equipment amounting to 83 passenger cars, 17,060 freight cars and 35 locomotives. The contracts reported by this journal since then are even more surprising in many ways, and when taken in connection with the large orders expected from the New York Central, Northern Pacific and other roads, show that the high records of 1901 and 1902 for freight equipment and locomotives will easily be surpassed before the close of 1905, although the volume of orders in those years was exceptional, and notwithstanding the present high prices and the difficulty in securing prompt deliveries.

The orders placed by the Pennsylvania a few days ago for 21,500 cars, in addition to the 16,160 ordered in August, made a new record in contracts placed by a single company, and practically preempts all steel car building facilities during the entire year of 1906. It is stated that all car manufacturers are crowded with orders and that the American Car & Foundry Co. alone have unfilled contracts aggregating over 60,000 cars, while no company can promise delivery before the middle of next year unless the order is for a few wooden cars. The greater number of the cars ordered during the current year are yet to be built and will keep the car manufacturers busy until well into the second half of next year.

From the detailed records kept by the "Railway Age" since 1901 of orders placed for new equipment, the following totals are taken, the figures for 1905 covering 41 weeks.

	1901.	1902.	1903.	1904.	1905.
Freight cars.	193,439	195,248	108,936	136,561	196,672
Pass. cars...	2,879	3,459	2,310	2,213	2,297
Locomotives.	4,340	4,665	3,283	2,538	4,131

It will be noted from the above table that orders for freight cars for the first 41 weeks of the current year are in excess of any previous year, while the contracts for passenger cars and locomotives, if continued at their present rate, will also exceed any previous record.

These statements of the "Railway Age" are not particularly gratifying to President Frederick H. Eaton of the American Car & Fdy. Co., who has commented on the situation as follows: "The statements that have been made in regard to the car builders of the country being filled up for the year 1906 are not only misleading to proposed buyers of equipment, but are likely to encourage inflation in prices of materials used in the construction of rolling stock, which would seriously affect manufacturing industries. The policy of all the large companies, including the steel manufacturers, has been to hold prices within conservative limits, so as to avoid any semblance of booms and place purchasers in a position to secure material for delivery months ahead of actual requirements at prices ruling at the present time. The car business is a stronly competitive one, and the production of the car companies is far in excess of the demand, being limited only by the supply of material. There are seven distinct companies engaged in the manufacture of steel cars, only one of which is filled up for the year 1906. Our company has five plants in operation on this class of cars, only two of which are filled up for one year ahead, and from some of our ten or twelve other plants we can make delivery of 20,000 to 25,000 cars, commencing in February, for completion by September next. The situation to-day is not particularly different from the past, according to the experience of old car builders, with the exception that orders have been placed for deliveries so much further in advance than usual. It is not the intention of our company to ask exorbitant prices for future deliveries, but with attractive figures to encourage the continual placing of orders, so that business may be carried on a steadier basis and prevent so-called booms that are so disastrous to good business conditions."

THE IRON AND STEEL SITUATION.

On Thursday of this week the "Iron Age" printed the following statement of the situation in the iron and metal trades: Bookings of finished iron and steel continue on an enormous scale, and thus far this month are nearly up to the record breaking rate of September. The pressure in many quarters is enormous and the plants are provided with work for long periods. There is the most intense activity in all directions. In the Eastern steel trade there has been another outburst of buying of basic pig iron for delivery during the winter, and fully 75,000 tons have been taken at advancing prices, with negotiations pending for at least half as much more. A scarcity of pig iron for steel making is developing in the Chicago district, and it is likely that iron may be shipped from lower lake ports to that district by water before navigation closes. The United States Steel Corporation has secured options at $16 and $16.50 on practically all the Bessemer pig available in the Mahoning and Shenango valleys till the end of the year, the only exception being one lot of 10,000 tons held by a merchant. These purchases of iron are necessary in spite of the fact that the Steel Corporation is operating all its blast furnaces except three, of which two are out for repairs. In the steel rail trade a number of fair orders have been booked and some additional large tonnage is looming up. Thus one system which has already bought 140,000 tons is again in the market for 20,000 tons more. Inability to make prompt deliveries of structural material continues to be the only serious phase of the situation in that branch.

THE SPOKANE & INLAND RAILWAY.

A contract has just been closed with the Spokane & Inland Railway Co. by the Westinghouse Electric & Mfg. Co., of Pittsburg, for the equipment of an electric road, the present terminals of which will be Spokane, Wash., and Moscow, Ida., 146 miles apart. The roadway is completed from Spokane to Waverly, a distance of 34 miles, and operation will be begun on this as soon as possible. The road is a home enterprise, the stock being held entirely by men living in the district through which the line passes, business men, professional men and farmers. The directors of the company are J. P. Graves, president, F. A. Blackwell, vice-president, F. Lewis Clark, John Twohy and Alfred Coolidge, all men of wealth who have been so long identified with enterprises of magnitude that their names insure the success of any undertaking with which they associate themselves.

In selecting the equipment for this road, both the combined alternating-current, direct-current and the single-phase systems were considered but, after careful comparison of the two, the single-phase alternating-current system was adopted. The estimates show a large saving in initial investments and in annual operating expenses in favor of the single-phase system. Besides the passenger traffic the company is preparing to do a heavy freight business and also to carry mail and express.

Power for the operation of the road will be purchased from the Washington Water Power Co., which will supply three-phase current at 4,000 volts, 7,200 alternations, to a frequency-changing station approximately 1½ miles from the generating station. Seven 750-kw. oil-insulated water-cooled transformers will step down the voltage from 4,000 to 2,000 volts, the potential for which the induction motors of the frequency-changing sets are wound. There will be four of these motor-generators or frequency-changers of 1,000-kw. capacity each at normal rating. Each consists of a 1,000-h.-p., three-phase, 2,000-volt, 60-cycle induction motor, a 1,000-kw. single-phase, 2,200-volt, 25-cycle revolving field alternator, and a 750-h.-p., 550-volt direct-current generator which is to float on the storage battery, acting alternately as a motor and generator. The three machines will be mounted on a single bed-plate with seven bearings. Exciting current for the alternators will be supplied by three sets, each consisting of a 75-h.-p., three-phase, 2,000-volt induction motor and a 30-kw. direct-current generator.

Nine 675-kw. oil-insulated water-cooled transformers will step up the voltage from 2,200 to 45,000 volts, at which pressure it will be transmitted to the fifteen static transformer sub-stations, each containing two 375-kw., 45,000-6,600-volt oil-insulated self-cooling transformers. A twenty-three panel switchboard, electrically operated automatic oil circuit-breakers, and protective apparatus complete the equipment of the frequency-changing station. Low equivalent lightning arresters and choke coils are provided for both primary and secondary circuits in all sub-stations.

The transmission lines will consist of two No. 2 copper wires, and the trolley will be of the standard catenary construction, using a 000 wire and carrying current at 6,600 voltss.

Each passenger car will be equipped with four 100-h.-p. motors, capable of maintaining a schedule speed of 36 to 40 miles an hour. In the freight service four 150-h.-p. motors will be used on each car. For the heavy freight service double locomotives weighing approximately 70 to 80 tons will be used, each consisting of two parts and each part a complete 35 to 40-ton locomotive. Two or more of these locomotives may be coupled together and operated from the front cab as a single unit. The motor cars and locomotives will all be operated by the Westinghouse multiple-unit control system. The motors will operate under three different conditions, 6,600 volts alternating-current in the interurban districts, 700 volts alternating-current in the smaller towns, and 575 direct-current in the city of Spokane.

PREVENTING DUST ON ROADS WITH WESTRUMITE.

A liquid preparation for preventing the formation of dust on roads and pavements, which has been widely used abroad, is being introduced in this country by the Westrumite Co. of America, a branch of the foreign company that controls its manufacture. The preparation was first used here on two miles of a drive in the boulevard system of Chicago. This drive has a Joliet limestone macadam surface and is one of two in a parkway several hundred feet wide which connects Jackson and Washington parks. It carries a large amount of light traffic and is subjected to most extreme weather conditions. One end has a narrow stretch of park area intervening between it and Lake Michigan, and the trees on both sides of the drive are small, so the full sweep of the heavy winds from the lake is received. The limestone is nearly white and is quite friable under traffic. Dust forms readily on the drive in summer and is blown away in clouds, while a sloppy mud covers its surface in wet weather. The preparation was first applied to the drive last spring and applications have been repeated at intervals of seven to ten days since then. The surface has become caked so that no dust is raised by wind or traffic and practically no mud formed by rains.

The preparation has as its principal ingredient a heavy oil, with an asphalt base and contains in addition various substances added to neutralize the objectionable features of the oil for use on highways. It is highly soluble when first exposed and mingles freely and immediately with water. It is applied to the road or street surface in a weak solution from an ordinary sprinkling cart and dries in one-half to four hours, depending on the temperature. After it is dry it becomes nearly insoluble and rain does not wash it away.

In the application of the preparation a portion of the liquid is first poured into a barrel or sprinkling cart with about an equal amount of water, then this mixture is pumped into the cart from which it is to be applied. The strength of the solution used depends on the condition of the surface to which it is to be applied. A solution of 8 to 10 parts of the liquid to 100 parts of water is first applied on two successive days to thoroughly saturate the roadbed; following this, applications of 3½ to 5 parts per 100 parts of water are added at intervals of 1 to 3 weeks, depending on the weather, traffic and nature of the roadbed.

The solution does not adhere to nor injure the tires of vehicles or clothing and is applied as water is sprinkled on a street, without closing the latter to traffic. There is a slight odor of ammonia when the application is first made, but this soon disappears, leaving no apparent odor after the road surface has been treated. The pure liquid has a heavy brown color, which changes to shades of yellow in the solution, depending in tone on the amount of dilution. The treated surfaces are turned slightly yellow, relieving the sun glare from them, especially from a light-colored macadam. The liquid absorbs about 6 per cent. of its own weight of water and after a rainfall tends to bind and cake together the dust already formed on the road surface, as well as that blown on it. This same absorbing quality is said to be sufficient to prevent the freezing of road surfaces in colder climates.

Although the preparation is particularly adapted to settling dust on dirt or macadam roads, it is held to be equally applicable to practically all kinds of pavements. Since the absorptive capacity of wood, stone-block and asphalt pavements is from 0.06 to 8 per cent., and then only in cases of dilute liquids, the application of a very weak solution of the preparation is said to keep the more dense pavements dustless for several days.

The compound is claimed to be useful in building dirt and macadam roads. In constructing the latter the practice is to saturate the sand, and binding material with a 25 per cent. solution of the compound, and then when rolling to use a 5 to 10 per cent. solution in place of clear water. This is said to reduce the amount of rolling required, preventing the softening of the foundation by excessive water sprinkling, as well as the partial pulverizing of the upper layer by excessive rolling. In addition it is further claimed that the street body may in most cases be made 10 to 20 per cent. thinner than in ordinary practice. A solution has also been used to saturate the dirt foundation and the joint filling in constructing brick, granite and stone-block pavements.

The actual cost of sprinkling road surfaces by this method is stated to be in most cases the same, if not less than the cost of water sprinkling, due chiefly to the labor saving. The real advantages of the use of the preparation as compared with water sprinkling, however, are claimed to be that the dust is laid continually; the binding material of a dirt or broken stone road is caked together; the formation of mud is largely prevented and the cost of street cleaning is reduced. In road construction the cost is given as 20 to 40 cents a square yard, which is said to be saved several times by the reduced cost of construction and maintenance and the increased life of the road.

A short piece of macadam road leading along the north shore of Staten Island, N. Y., from the New York City ferry terminal has recently been treated with the compound. The macadamized portion of this road averages 28 ft. in width, with a 3-ft. gutter along one side. Two street car tracks at the opposite side from the gutter occupy 15 ft. of this width, leaving a 13-ft. strip between the tracks and the gutter on which most of the traffic is concentrated. A traffic census taken some time ago gave 421 vehicles passing in 9 hr.; of these 90 were loaded double trucks and 68 were business wagons. The macadam is on a telford base, and wears very rapidly under the heavy traffic to which it is subjected, so between the ferry terminal the portion of the road that has been treated granite blocks have been or are being substituted for it.

The preparation that has been used in this country thus far has been imported, but a factory is being erected for its manufacture in Chicago. The trade name of Westrumite has been applied to the compound by Mr. Leonard Schade van Westrum, who developed and has patented the process of its manufacture.

RUSSIA'S RETALIATORY DUTIES.

The official announcement that the Russian Government has ordered that the levying of discriminating import duties on a number of articles, the products of the United States, be discontinued, lends interest to figures presented by the Department of Commerce and Labor through its Bureau of Statistics, showing the total imports into Russia from the United States during the calendar years 1900-1904, inclusive, as well as the imports during the period 1900-1903 into Russia from the United States of the articles affected by the adverse tariff legislation.

The application of the higher discriminating rates dates back to the beginning of the year 1901, when, in retaliation of the countervailing duty imposed upon sugar of Russian origin in accordance with section 5 of the Dingley tariff, the Russian minister of finance ordered the application of the penal tariff rates to imports of manufactures of cast iron, of hand tools, machinery, and numerous other articles classed under the general head of manufactures of iron and steel. These articles, which were subject until then to the same conventional rates as were paid by like articles coming from Germany and other European countries, became subject to rates from 30 to 50 per cent. higher.

In May of the same year an order of the Russian minister of finance raised the rates on white rosin, pine pitch, and brewers' pitch by 20 per cent., and that on velocipedes by 30 per cent., which higher rates have prevailed since.

In order to be able to determine the origin of the articles affected, the Russian Government also ordered the presentation of certificates of origin in case the goods bore no trade marks or other proofs of their real origin. It is interesting to note that the total imports into Russia from the United States, as shown by the official trade returns of the Russian Government, show but little the effects of the adverse tariff legislation. Thus the total imports from this country are stated by the Russian returns as follows: 1900, $22,748,000; 1901, $17,984,000; 1902, $20,574,000; 1903, $32,531,000. Preliminary figures for the year 1904, showing the imports from the United States into Russia over the European frontier only, are $32,163,000. The corresponding figures of the Bureau of Statistics, showing the total exports from this country to Russia during the same calendar years, are as follows: 1900, $8,664,270; 1901, $7,207,995; 1902, $13,835,953; 1903, $18,994,548; 1904, $17,823,856.

While the figures of the two Governments, measuring the same trade movement for the same period, show wide discrepancies, neither of them discloses any serious effect of the discriminations upon the growth of the general trade movement. The main reason for this phenomenon is that the bulk of imports into Russia from the United States is made up of raw cotton, the imports of which from this country for the years in question appear to have been as follows: 1900 $18,417,000; 1901, $12,467,000; 1902, $13,595,000; 1903, $24,338,000; 1904, $24,060,000.

By comparing the values of the cotton imports with those of the total imports into Russia from this country, it is seen that the larger or smaller size of the total import figures for the respective years depends mainly upon the magnitude of the figures showing the cotton imports from the United States during the same periods.

An analysis of the figures showing the imports from the United States of the various articles affected by the discriminating tariff legislation furthermore shows that these imports have, on the whole, increased during the period in question. Thus, the imports of manufactures of cast iron increased from $19,955 in 1900, which, for purposes of this comparison, may be taken as a normal year, to $45,722 in 1903; hand tools, from $15,315 to $64,532; machinery, from $223,529 to $338,694, while imports of the various articles under the general head of manufactures of iron and steel increased from $45,373 in 1900 to $363,555 in 1902, and fell off to $67,555 during the following year. The same is true of bicycles, the imports of which, from $10,836 in 1900, increased to $43,087 in 1902, but fell to $30,377 during the following year. The imports of the articles under the general head of naval stores more than doubled—from $186,552 in 1900 to $404,226 in 1903. The combined figures of imports from the United States of the articles subject to discriminating duties show an increase from $501,558 in 1900 to $951,106 in 1903.

A WEEK'S BUSINESS IN STEAM TURBINES.

During the week ending Sept. 29, the Westinghouse Companies of East Pittsburg, Pa., received orders from the Toledo Gas, Electric & Heating Co., Toledo, O., for two 1,000-kw. turbo-generator sets; from the Pennyslvania Railroad Co. for four 500-kw. turbo-generator sets; from the Water, Light & Gas Co., Hutchinson, Kan. for two 500-kw. turbo-generator sets, and from the Solvay Process Co., of Syracuse, N. Y., for one 500-kw. turbo-generator set. Each turbine will be of the type known as the multiple expansion parallel flow with an overload capacity when running condensing of at least 50 per cent., and the alternating-current generators will be of the turbo type with rotating fields.

The turbines for the Toledo Gas, Electric & Heating Co. will be adapted for driving a direct-connected, 60-cycle generator running at 1,800 r.p.m. and giving 7,200 alternations per minute, each being capable of developing 1,500 b.h.p. when operating at 1,800 r.p.m. with dry saturated steam at the throttle of 150 lb. pressure and 28-in. vacuum in the exhaust pipe. They will be provided with secondary governor valves by means of which 50 per cent. overload may be developed, or full load developed when operating with condenser. The generators will have four poles and will deliver three-phase current at 4,400-4,800 volts. The generator frames will be of the enclosed type with the latest system of ventilation.

The two 500-kw. turbines for the Water, Light & Gas Co. will operate with dry saturated steam at the throttle of 150 lb. pressure and 28-in. vacuum. The 60-cycle generators will deliver two-phase current at 2,200 volts.

The 500-kw. steam turbine for the Solvay Process Co. will operate with dry saturated steam at the throttle of 125 lb. gauge pressure and 28-in. vacuum. The 60-cycle, direct-connected turbo-generator will deliver two-phase current at 440 volts. This company already has in operation a number of Westinghouse steam and gas engines, in addition to 3,600 hp. in Roney mechanical stokers. Westinghouse apparatus is also installed in the Detroit plant of this company.

A PORTLAND CEMENT PLANT FOR KANSAS CITY.

The Pyramid Portland Cement Co. has been organized in Kansas City, Mo., and has secured a charter under the laws of the State of New York, where it maintains an office. The property of the company is located in the suburbs of Kansas City, Mo., and consists of 120 acres of limestone nearly 200 ft. in height covering the entire area and underlaid with a 20-ft. bed of shale. The rock and shale have been analyzed by several assayers, including the Geological Departments of the States of Missouri and Kansas, and found to be the equal in every respect of the great limestone beds of Kansas of practically the same formation, except that by an upheaval of nature it has been thrown above the surface of the surrounding territory. Three railroads run beside the property and it has a frontage of nearly three-quarters of a mile on the Missouri River.

For fuel the company can use oil, which can be obtained in unlimited quantities at the great refinery of the Standard Oil Co., situated on the adjoining property, or it can use natural gas, of which there are several wells in the vicinity, and coal can be obtained over any of the railroads or by river transportation, delivery being right on the grounds in either event. The company has also the choice, if it so desires, of mining coal on its own land as it has a good 28-in. vein at a depth of 260 ft.

The company is capitalized at $700,000 and will commence the erection of a plant immediately. The machinery equipment of the Pyramid plant will be rotary kilns and ball mills and the power will be electricity, each individual machine being driven by a separate motor. Contract for the machinery will soon be placed and it is expected to have the plant in full running order, turning out 1,200 barrels per day, in the early spring.

BUSINESS NOTES.

The Pennsylvania R. R. has recently placed an order with The Westinghouse Machine Co. for six 132x26-in. and four 100x20-in. grate Roney mechanical stokers, to extend its already large equipment at Altoona.

The Bury Compressor Co., Erie, Pa., will have one of its compressors on exhibition at the Paris Automobile Show in December. It will furnish air to operate the numerous American appliances sold in Europe by Messrs. Fenwick Freres & Co.

A large air compressor has recently been supplied to the North Carolina Granite Corporation, Mt. Airy, N. C., by the Sullivan Machinery Co., Chicago. It is rated at 2,000 cu. ft. of free air per minute at 78 r.p.m. and furnishes air for drills and other tools at the company's quarries. The steam end is a Sullivan Corliss cross-compound condensing engine. The air inlet valves of the two-stage air end are of the Corliss type operated by independent eccentrics. The discharge valves on both cylinders are of the automatic poppet type, moving in a direction parallel with the piston rod, and have removable seats in the cylinder heads. The devices for cooling the air during compression are stated to be unusually efficient. A similar machine has been running for two years at the works of the Southern States Portland Cement Co. at Rockmart, Ga.

The York Mfg. Co., York, Pa., has recently closed a large number of orders for ice making and refrigerating machinery, of which a partial list follows: Western Chemical Co., Denver, Colo., 10-ton compression side; S. W. Calhoun, Chicago, 6-ton refrigerating machine for Hinesdale, Ill.; Regal Bottling Works, Hanover, Pa., 1¼-ton refrigerating station; Maier & Zobelein, Los Angeles, 125-ton cross-compound condensing machine and compression side; People's Brewing Co., Trenton, N. J., 175-ton refrigerating compression side; Crystal Ice Co., Salisbury, Md., 15-ton ice plant; Mountain Ice & Coal Co., Pueblo, 25-ton ice plant; Shaefer, Shaefer & Tefft, Spokane, 25-ton ice plant; Peoples Ice & Cold Storage Co., Coffeyville, Kan., 20-ton ice plant; Paul Conida, 10-ton compression side and brine cooler plant; Kensington Farm, Kensington, Ga., 1¼-ton refrigerating plant; B. F. Kokal, Carni, Ill., 25-ton ice plant; Sponseller & Hall, Hoisington, Kan., 10-ton ice plant; A. K. Stokee, Bay St. Louis, Miss., 25-ton ice plant; H. S. Ackelson, Oberlin, O., 10-ton ice plant; Cudahy Packing Co., Sioux City, Ia., 250-ton compound compression side and brine tank system; Santa Fe Ice Co., Cleburne, Tex., 30-ton refrigerating machine; St. John's College, New York, 3-ton refrigerating machine; W. C. Alexander, Murphysboro, Ill., 60-ton ice plant and 30-ton refrigerating plant; Ohio Dairy Co., Toledo, O., 30-ton refrigerating plant; W. A. Crawley, Tutwiler, Miss., 20-ton ice plant; Crystal Ice Co., Washington, D. C., 25-ton ice plant; Port Richmond Hygeia Ice & Cold Storage Co., Mariner's Harbor, N. Y., 15-ton ice plant; Flower City Brewing Co., Rochester, N. Y., 6-ton freezing system; Durham Traction Co., Durham, N. C., 50-ton ice plant, 17-ton freezing and distilling system; Canadian Breweries, Montreal, P. Q., 30-ton compression side and direct-expansion piping; Agar Cross & Co., New York, four ½-ton ice plants and a 6-ton refrigerating plant for export to Buenos Ayres.

The steam engine business of The Westinghouse Machine Co. during the last few weeks has amounted to over 75 engines aggregating 10,764 h.-p. Of them, 5,040 h.-p. were marine type, 2,740 h.-p. were compound steam engines, 1,823 h.-p. were Standard type, 801 h.-p. were Junior engines, and the remainder were Corliss engines. The largest single order was from the Tehuantepec Ry., of Mexico, for four 16 and 34x16-in. marine type engines and two 8½x8-in. Standard engines for its Salina Cruz and Coatzacoalcos power houses. Other orders were from the Rio de Janeiro Tramway, Light & Power Co., of Brazil; the Chicago, Milwaukee & St. Paul Railway Co., Chicago, Ill.; the Lawrence Machine Co., Lawrence, Mass., Pennsylvania Railroad Co., Wilmore, Pa.; Hokkaido Tanko Railway Co., Japan; Muncie & Portland Traction Co., Portland, Ind.; International Steam Pump Co., New York; Kure Arsenal, Japan; Graham Brothers, Stockholm, Sweden; Vesta Coal Co., Pittsburg, Pa.; Gray Mfg. Co., Gastonia, N. C.; Furukswa Western Bureau, Japan; Home Light, Heat & Power Co., Springfield, O.; Erie Railroad Co.; Great Falls & Old Dominion Railway, Baltimore, Md.; The Sidney Electric Co., Sidney, O.; Kiuskiu Railway, Japan; Imperial Printing Office, Japan; Waltham Gas Light Co., Waltham, Mass.; Lumberton Cotton Mills, Lumberton, N. C.; American Car Heating Co., and Santa Cecelia Sugar Co., Cuba.

Wm. B. Scaife & Sons Co., Pittsburg, Pa., have been awarded contract by the Washington Coal & Coke Co. for the structural steel work required for their large power plant at Star Junction, Pa.

A. Brooks Celiax, consulting engineer, reports that a State and county road at Atlantic City, N. J., known as the Meadow Boulevard, has been completed by Celiax & Caldwell, contractors, Philadelphia, and accepted by County Engineer J. J. Albertson.

PERSONAL NOTES.

Col. George M. French has been elected city engineer of Hot Springs, W. Va.

Capt. Chas. H. McKinstry, Corps of Engineers, U. S. A., has been assigned to duty as engineer of the Twelfth Lighthouse District.

Mr. George H. Blakeley, chief engineer of the Passaic Steel Co., of Paterson, N. J., since 1890, will give up that position on Nov. 1.

Mr. J. C. Herring, senior member of the Herring-Hertel Engineering & Construction Co., Jefferson City, Mo., has been appointed city engineer of Fulton, Mo.

Frederick Grinnell, inventor of the automatic sprinkler bearing his name and for many years president of the General Fire Extinguisher Co., died at New Bedford, on Oct. 21.

Mr. J. C. Thorpe has resigned as assistant professor of mechanical engineering in the University of Washington at Seattle, Wash, and joined the engineering staff of Sargent & Lundy, in Chicago.

Mr. Hugh Hazelton has resigned as electrical engineer, Manhattan division, Interborough Rapid Transit Co., of New York City, and becomes electrical engineer of the Hudson Companies, also of New York.

The State Engineering Society of Texas elected the following officers at its recent convention in Austin: President, Prof. T. V. Taylor, of Austin; vice-president, John D. Rullman, of San Antonio; secretary, E. C. H. Tanter, of Austin.

The Western Pacific contract of Deal Bros. & Mendenhall, of Springville, Utah, will be in charge of Mr. F. E. Baxter, who has resigned his position as division engineer of the Denver & Rio Grande Ry., in order to take up this work.

Mr. H. T. Douglas, Jr., consulting engineer of the Wheeling & Lake Erie, Wabash Pittsburg Terminal and West Side Belt Lines, has been appointed chief engineer of these roads in place of Mr. Barnsley, whose resignation was announced last week.

Mr. Charles W. Lawrie, who has acted as consulting engineer for many leading builders of high-speed engines in the United States, and for several years was general superintendent of the Ball Engine Co., will become general superintendent of the Reeves Engine Co., of Trenton, N. J., on Nov. 1.

Samuel Parsons, Jr., the well-known landscape architect, has been appointed acting commissioner of the Department of Parks, New York City, until a successor to Commissioner Pallas, who recently died, can be appointed. Mr. Parsons is a graduate of Sheffield Scientific School, was associated for many years with Calvert Vaux, and was superintendent of the public parks of New York for 15 years, resigning to go into business. He has just completed the plans for a 1,500-acre park for San Diego, Cal.

The Pennsylvania Water-Works Association elected the following officers at its meeting last week at Atlantic City: President, Frank Forbes, Greensburg; vice-presidents, M. K. Watkins of Mt. Carmel, John T. Taylor of Beaver Falls, M. H. Bowman of Uniontown; secretary and trasurer, F. S. Purviance of Pittsburg; executive committee, W. A. Crist of Johnstown, C. F. Brown of Williamsport, C. O. Wililams of Shamokin, Murray Forbes of Greensburg, John F. Sprenckel of York, W. C. Hawley of Wilkinsbuug.

There has recently been considerable change in the engineering department of the South & Western Ry., the coal road having its main offices in Bristol, Tenn. Mr. G. A. Kent has been made chief engineer of the land department and his duties as chief engineer of the railway have been assumed by Mr. M. J. Caples, general manager. Mr. W. A. Hankins has been made locating engineer, Mr. Walter A. Doane principal assistant engineer, and Messrs. C. H. Crosby and A. W. Jones division engineers.

The resignation of Mr. W. L. Darling as chief engineer of the Rock Island system, which was mentioned in this column two weeks ago, has been followed by his appointment as chief engineer of the Pacific R. R. Co. This company was incorporated early in the month with Mr. B. R. Williams as president. The latter has been general manager of the Chicago, Milwaukee & St. Paul Ry., and it is understood that the company of which he is the head has been formed to build a part of the St. Paul's extension to the Pacific Coast.

The engineering profession lost one of its most useful members by the death of Sir Edward Hamer Carbutt, on Oct. 8. He was born in Leeds in 1838. He served an apprenticeship in the locomotive works of the Midland Ry. and after a few years' practical work, formed a partnership with Mr. Robinson Thwaites which has developed into Thwaites Bros., Ltd. The firm undertook the manufacture of steam hammers and general machinery for iron and steel works, and later was very successful in introducing the Root blower. The business developed so rapidly that Sir Edward was able to retire in 1878, when he entered public life. He was mayor of Leeds in that year, and shortly afterward was elected to Parliament, where he served with much distinction on account of his engineering knowledge and sound judgment until the overthrow of the Liberal party in 1886. After that date, he was a diligent worker for various undertakings of the British engineering societies and the National Physical Laboratory.

The following degrees were given Oct. 18 at the exercises held in connection with the installation of Dr. Edmund Janes James as president of the University of Illinois: Doctor of Engineering, Octave Chanute, consulting engineer, Chicago, Ill., past president of the American Society of Civil Engineers, and F. E. Turneaure, dean of the college of engineering of the University of Wisconsin; Doctor of Laws, Daniel H. Burnham, architect, Chicago; Civil Engineer, August Ziesing, president American Bridge Co.; and Mechanical Engineer, J. V. Schaeffer. An engineering assembly was held Oct. 19 as a part of the exercises, the principal address being given by Dr. W. F. M. Goss, dean of the college of engineering of Purdue University. Short addresses were also made by Messrs. F. E. Turneaure, Octave Chanute, Wm. L. Abbott, chief operating engineer Chicago Edison Co.; C. H. Blackall, architect, Boston; Charles C. Benjamin, professor of mechanical engineering Case School of Applied Science; Henry T. Boney, dean of the faculty of Applied Science, McGill University, and General William Sooy Smith, consulting engineer, Chicago.

Mr. Philip P. Barton has been appointed general manager of the business and operations of the Niagara Falls Power Co. and the Canadian Niagara Power Co. This appointment also includes that of general manager of the Niagara Junction Ry. Co., and of the Niagara Development Co. Mr. Barton graduated from Cornell University in 1886, and then took two years of post-graduate work in electrical engineering at the same institution. His professional career was begun in the electrical department of the Cambria Iron Co., at Johnstown, Pa. After several months of practical experience there and with the Allegheny County Light Co., of Pittsburg, he entered the engineering force of the Westinghouse Electric & Mfg. Co. For some years he was engaged in installing electric lighting and power plants in various parts of the country, mainly in the South and the West. In 1892, he entered the service of the Brush Electric Co., of Cleveland, O., in charge of engineering and sales at its Pittsburg office. After the closing of that office in February, 1898, he was connected for some months with the Pittsburg office of the General Electric Co. In September, 1898, he became assistant superintendent of the Niagara Falls Power Co., at Niagara Falls, and two years later was made superintendent of the operating department of the same company. In July, 1905, he was appointed superintendent of operation of the Niagara Falls Power Co. and of the Canadian Niagara Power Co., which position he has held until his present appointment.

TRADE PUBLICATIONS.

The destruction of Henderson's Point in Portsmouth harbor on July 22 is the subject of an interesting bulletin issued by the Sullivan Machinery Co., Railway Exchange, Chicago. This work was noteworthy for the large size of the final blast and the manner in which the excavation was conducted and the blasting holes drilled. The bulletin is an unusually complete description of the undertaking and deserves a permanent place in the library of the engineer and contractor.

The type A air compressor made by the Blaisdell Machinery Co., Bradford, Pa., is described in Bulletin 15 of that company. This is made with single and duplex steam cylinders, single and double-stage air cylinders, and for belt driving. The bulletin describes the design of the most important parts and gives full tables of the sizes and capacities of the various styles of machines.

The Premier water meter for measuring the flow in large mains is fully described in a pamphlet issued by the National Meter Co., New York. This device was described in The Engineering Record of May 21, 1904, but since that time it has been furnished with an automatic recorder which can be placed any distance from the meter itself. The pamphlet describes the construction of the meter, explains the conditions for use and its accuracy and resistance to flow, and gives the results of a number of tests made with a 16-in. apparatus.

A line of tools for cement users, comprising jointers, edgers, curbing and tucking tools, tampers and the like, has lately been placed on the market by the Century Cement Machine Co., Rochester, N. Y., which has prepared a catalogue illustrating them.

The National Ventilating Co., 1 Madison Ave., New York, has issued a book on natural ventilation and the apparatus it makes for producing it. This has been employed in many schools, shops and offices, and a considerable portion of the contents of the book consists of letters from such users. The description of the principles of the apparatus is quite complete and the illustrations of the various forms of equipment are numerous. Special stress is laid on extracts from the recent report of a select committee on ventilation appointed by the House of Commons, in which natural ventilation is highly commended.

The first announcement concerning the Westinghouse storage batteries for railway signal service is given in a well-illustrated booklet from The Westinghouse Machine Co., East Pittsburg, Pa. These batteries have been designed particularly with a view to exceedingly long life, complete freedom from injurious sulphation, maximum efficiency, and ability to operate with high efficiency at rapid rates of charge and discharge. Two diagrams in the booklet show the variation in capacity with percentage rate of discharge and with rate of discharge in hours.

Catalogue 18, issued by the Yale & Towne Mfg. Co., New York, describes the most popular locks made by it, such as should be carried by retail hardware dealers and general stores. The book is profusely illustrated, and in addition to its trade lists has a glossary of terms relating to locks, a history of the Yale lock, a brief biography of Linus Yale, Jr., a sketch of the rise of the company itself, and chapters on the construction of locks, lock-picking, master-keyed locks and the construction of doors.

The Association of American Portland Cement Manufacturers, 1232 Land Title Bldg., Philadelphia, has published for general distribution the papers read at its recent Niagara Falls convention. These are: "Methods of Testing and Some Peculiarities of Cement," by W. A. Aiken; "The Decoration of Concrete with Colored Clays," by Henry C. Mercer; "The 1905 Meeting of the Association of German Portland Cement Manufacturers," by S. B. Newberry.

The Gold Car Heating & Lighting Co., New York, has issued a large book describing in much detail the steam, hot water and electric heating apparatus it manufactures for all kinds of cars.

The fourth and last number of "Air Power," issued by the Rand Drill Co., 11 Broadway, New York, contains a number of valuable articles. Mr. W. R. Hulbert describes briefly many of the uses of compressed air in railroad work, there are descriptions of the large compressed air plant of the Center Star Mine at Rossland, B. C., the air lift equipment of the Savannah water-works, and the new compressor plant at the Corra mine, Butte, and an article by F. M. Hitchcock on the air required to operate rock drills.

The pumping machinery catalogue of The Deming Co., Salem, O, describes a great number of triplex, deep-well, centrifugal, rotary and piston pumps, and the strainers, valves and other specialties used with them. The catalogue is of interest, aside from its multitude of useful tables concerning pumps, on account of its excellent engravings of typical pumping plants driven by steam and gas engines and electric motors. Some of these views are decidedly instructive, such as one showing an installation driven by either a gas engine or a motor, thereby having reserve power for any conceivable emergency.

The Foos gas and gasoline engines have now been on the market for 18 years, and the fact that the demand for them is steadily increasing is ample proof of their high character. They are built with capacities of 2 to 80 h.-p., but all on exactly the same design, which is described in great detail in the new catalogue of the makers, the Foos Gas Engine Co., Springfield, O.

The Kingsley Water Tube Boiler Co., 21 State St., New York, has published a catalogue in which special stress is laid on the economy of space occupied by its boilers in comparison with those of other types.

Engineers and architects interested in reinforced concrete will find in the new catalogue of the Truss Metal Lath Co., 15-25 Whitehall St., New York, complete illustrated descriptions of the system of partitions, roofs and flooring used in many buildings where it is desirable to dispense with special rods and stays and rely on the reinforcement for stiffness.

For some years the facilities in shops for handling loads of ½ to 5 tons were rather limited. For loads exceeding 5 tons the standard traveling crane is entirely adequate, but below that weight it is expensive. To supply the means for handling the light loads the Niles-Bement-Pond Co., 111 Broadway, New York, has designed a line of electric traveling trolleys and hoists which are illustrated in a large catalogue devoted wholly to them. These trolleys run as a single I-beam, and can be installed in many places where crane runways are impracticable.

The Industrial Engineering Co. of America has been organized to design industrial plants and machinery, power plants, heating and lighting equipments, and to superintend their construction and fitting up. Mr. C. M. Conradson is chief engineer and Mr. F. L. Howard manager of the company, which has its offices at 32 Broadway, New York. It has recently published a book describing the work done by members of the company and explaining the field it covers.

A description of the A. B. C. heater, for use in hot-blast installations, is given in the latest catalogue of the American Blower Co., Detroit. The construction is explained, tables and diagrams of capacities are given, and there are numerous illustrations of different types of installation.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Gravette, Ark.—See "Power Plants, Gas and Electricity."

Salinas, Cal.—Articles of incorporation for the Monterey County Water Works are reported to have been filed with the County Clerk. San Francisco is given as the place of business; capital, $1,000,000. Directors: Chas. E. Green, H. G. Platt, A. D. Shepard, and others, all of San Francisco.

Fresno, Cal.—The Fresno Water Wks. Co. is reported incorporated to build a pumping plant on McKenzie and Clark Sts., at a cost of $20,000. Directors: A. G. Wishon, W. E. Durfey and Jos. H. Newlin.

Sterling, Colo.—Press reports state that bonds to the amount of $45,000 have been ordered sold by the Town Trus., the proceeds to be used for improvement of the water works. It is further reported that bids are wanted for furnishing material and replacing the present wooden pipe line with 10-in. c.-i. pipe.

Gunnison, Colo.—C. H. Fitch, Superv. Engr., U. S. Reclamation Service, writes that all bids opened on Sept. 26 for the completion of Gunnison Tunnel for the diversion of water from Gunnison River to Uncompahgre Valley, Colo., have been rejected and the work will be carried on by the U. S. Government. The lowest bid received for this work amounted to $1,541,100. For detail bids received for this work, see issue of The Engineering Record Oct. 7.

Milledgeville, Ga.—All bids opened on Oct. 18 by the Bd. of Trus. of the Georgia State Sanitarium for constructing water works and a filtration plant for the Sanitarium, have been rejected, and new bids will be received until Nov. 15, as advertised in The Engineering Record. T. H. De Saussure, Engr., Georgia State Sanatarium.

**Lewiston, Idaho.*—H. L. Powers, Room 3, Chamber of Commerce Bldg., Portland, Ore., Mgr. Lewiston-Sweetwater Irrigation Co., writes that Naylor & Norlin, of Lewiston, have secured the contract for constructing the proposed irrigation system.

St. Charles, Ill.—Chas. A. Miller, City Attorney, writes that F. E. Glenn, G. P. Marvin and Henry Roehlk are the committee in charge of the proposed water works, which will cost about $50,000.

Casey, Ill.—B. B. Sturdevant, City Clk., writes that the engineer has not yet been selected for the proposed water works.

Minooka, Ill.—All bids opened on Oct. 20 by the Village Bd. of Trus. (M. L. Kaffer, Clk.) are stated to have been rejected and new bids will be received.

Arlington Heights, Ill.—Henry C. Klehm, Pres. Bd. Trus., writes that all bids opened on Oct. 18 for extending the water system have been rejected. The matter has been dropped.

Columbus, Ind.—Geo. Vorwald, City Clk., writes that owing to the high condition of White River in the fall and winter, nothing will be done until next year on the wooden filtration gallery in White River.

Madrid, Ia.—A. M. Ozburn, 508 Great Northern Bldg., Chicago, Ill., has secured the contract for furnishing pipe, hydrants, valves, etc. (bids opened Oct. 18) for a total of $12,070, including a 120-ft. tower and 50,000 gal. tank, which was sublet to the Chicago Bridge & Iron Wks. Ludlow valves and hydrants will be used. The successful bidder bid $9 per cu. yd. for Portland cement concrete; $7.59 per cu. yd. for Portland cement masonry; 65 cts. per lin. ft. for 4-in. c.-i. pipe; 87 cts. for 6-in. c.-i. pipe, and $1.12 for 8-in. c-i. pipe. The totals of the other bids submitted were as follows: W. D. Lovell, Minneapolis, Minn., $13,240; Des Moines Bridge & Iron Wks., Des Moines, $13,490; Dwyer Plumbing & Htg. Co., St. Paul, Minn., $13,600, and Hanley-Casey Co., Chicago, Ill., $14,500. Engineers, Burns & McDonnell, Dwight Bldg., Kansas City, Mo.

Independence, Ia.—See "Power Plants, Gas and Electricity."

Topeka, Kan.—It is stated that the City Engr. estimates the cost of making the necessary extensions and improvements to the boiler house at the water works pumping station, at $5,287.

Donaldsonville, La.—The Mayor writes that it is proposed to remodel and extend the water works. About 50 hydrants with 2 openings and some 12, 10, 8 and 6-in. pipe and valves will be needed. About $30,000 will be expended on the improvement. A. E. Thibodaux, City Engr.

Abbeville, La.—W. Mackintosh, of Abbeville, Consulting Engr., writes that bids for constructing water works and a sewerage system will be called for in about 30 days.

Salem, Mass.—Freeman C. Coffin, 53 State St., Boston, is making an investigation to ascertain what can be done with regard to improving and increasing the present water supply of Salem and Beverly.

Fitchburg, Mass.—The Water Comrs. have been authorized to extend supply pipe to Wachusett Lake for additional supply. Pipe will be purchased for delivery during the winter, and will be laid next season by day labor. Total length about 6,000 lin. ft. 24 or 30-in. pipe. Thos. C. Lovell, Supt. Water Wks.

**Rochester, Mich.*—W. J. Taylor, Village Clk., writes that Geo. H. Miller & Co., of Mt. Clemens, have secured the contract for constructing a 2,000,000-gal. reservoir at the water works (bids opened Oct. 9) for $5,820.

Foley, Minn.—See "Power Plants, Gas and Electricity."

Starkville, Miss.—See "Power Plants, Gas and Electricity."

Neosho, Mo.—The Council is reported to have passed an ordinance providing for the construction of water works, to cost about $40,000.

**Kansas City, Mo.*—A. M. Blodgett, of Kansas City, has secured the contract for furnishing material and constructing 2 shafts of 8 ft. inside diam. and connecting same under Kaw River with a tunnel 7 ft.. inside diam. and 1,125 ft. in length (bids opened Oct. 14) for $78,737. This was the only bid received for the work.

Mitchell, Neb.—Plans and specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the construction of about 50 miles of main canal, involving about 3,000,000 cu. yds. earthwork and 130,000 cu. yds. rock work for the irrigation of lands in North Platte Valley, Wyo. and Neb., bids for which will be received at the office of the U. S. Reclamation Service, Denver, Colo., until Nov. 8, as advertised in The Engineering Record.

Orange, N. J.—The following are reported to be the totals of the 4 lowest bids opened on Oct. 23 by the Common Council for constructing new distributing system: Antonio Costa, Orange, $187,407; Thos. E. Vermilyea, New York, N. Y., $204,635; Ludwig Batt, South Orange, $218,007, and John F. Driscol, Orange, $244,181.

Garfield, N. J.—Bids will be received until Nov. 1 for furnishing 100 water meters, ⅝-in. size, as advertised in The Engineering Record.

Roswell, N. M.—The only bid received and opened on Oct. 17 by the engineer, U. S. Reclamation Service, Roswell, for constructing earth embankments, etc., about 12 miles from Roswell, was submitted by Wood, Bancroft & Doty, of Omaha, Neb., at the following bid: 7,900 cu. yds. earth embankment, No. 3, at 17 cts. per cu. yd.; 195,500 cu. yds. earth embankment, No. 4, 17 cts.; 150,000 cu. yds. overhaul, per cu. yd. per 100 ft., 1½ cts., and 100 cu. yds. puddling, 80 cts. W. M. Reed, of Roswell, is Constructing Engr., U. S. Reclamation Service.

New York, N. Y.—The following are the bids opened on Oct. 25 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, constructing and installing 5 electrically-driven pumps, with all appliances complete, for high-pressure fire service, in a pumping station to be erected on Oliver and South Sts., Boro. of Manhattan. Allis-Chalmers Co., Milwaukee, $119,635; D. Olier Eng. Co., 74 Cortlandt St., $128,570; Camden Iron Works, Camden, N. J., $119,848, and Johnston Livingston, Jr., Co., 113 E. 22d St., $124,957. The detail bid of the lowest bidder, the Allis-Chalmers Co., is as follows: 2,500 cu. yds. excav., $1; 350 cu. yds. concrete, $6.75; 4,000 lin. ft. piling, 30 cts.; 30,000 lbs. iron for flooring, 3½ cts. and for the 5 pumps, $112,523.

Bids will be received until Nov. 8 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in Columbus and 9th aves., 62d St., Central Park W. and in Central Park.

New York, N. Y.—The following are the bids opened Oct. 25 by John T. Oakley, Comr. Water Supply, Gas and Electricity for furnishing, constructing and installing 5 electrically-driven pumps, with all appliances complete, for high-pressure fire service, in a pumping station to be erected on Gansevoort and West Sts., Boro. of Manhattan. (*a*) Johnston Livingston, Jr., Co., 113 E. 22d St., (*b*) Dillier Eng. Co., 74 Cortlandt St., (*c*) Camden Iron Works, Camden, N. J., (*d*) Allis-Chalmers Co., Milwaukee, Wis.

	a	*b*	*c*	*d*
2,500 cu. yds. excav.	$2.00	$3.00	$2.00	$1.00
350 cu. yds. concrete	8.00	8.00	9.00	6.75
4,000 lin. ft. piling..	.28	.35	.40	.30
30,000 lbs. iron floor castings	.03½	.03½	.03½	.03½
5 pumps with all pipes, valves, meters, connections, etc.	114,987	113,746	109,048	112,523
Totals	$124,957	$126,496	$119,848	$119,635

Brooklyn, N. Y.—Bids will be received until Nov. 8 by John T. Oakley, Comr., Water Supply, Gas and Electricity, New York City, for constructing 2 additional filter beds, with all their appurtenances complete, near the Hempstead Storage Reservoir, Hempstead, Long Island.

Buffalo, N. Y.—Bids will be received until Nov. 3 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for furnishing material and erecting a red brick chimney, 250 ft. high and 11 ft. internal diameter, at the Pumping Station, Bureau of Water.

Briarcliff Manor, N. Y.—The Briarcliff Water Co., of Briarcliff Manor, has been incorporated, with a capital of $50,000, by Walter W. Law, David B. Plumer, and others, all of Briarcliff Manor.

**Perrysburg, O.*—Contracts have been awarded as follows (bids opened Oct. 18) by the Bd. of Pub. Affairs: For steel tank and tower, Chicago Bridge & Iron Wks., $2,756; pipe and special work, $8,029, and valves and hydrants, Rensselaer Mfg. Co., $1,113. Engineers, Riggs & Sherman Co., Toledo.

**Lorain, O.*—We are informed that the contract for constructing and equipping a filtration plant, bids opened by the Bd. of Pub.. Service on Oct. 9 has been awarded to the Pittsburg Filter Co., of Pittsburg, Pa., for $40,000. The Norwood Eng. Co., of Florence, Mass., bid for this work $42,300. The bids were received for the job complete, and each bidder furnished its own plans.

Oklahoma City, Okla. Ter.—The City Council is stated to have appointed O A Mitscher, J M. Owen and T. M. Williamson as an advisory board to serve in the matter of the adoption of plans, letting of contracts, and supervising the construction of water works and sewers, providing the citizens vote in favor of such construction at the election Nov. 14.

Panama.—Bids will be received until Nov. 11 by the Isthmian Canal Comn. (D. W. Ross, Gen. Purchasing Agt.) Washington, D. C., for filters, iron pipe, round iron, planing mill machinery, wire cables, locks, etc.

**Williamsburg, Pa.*—The International Constr. Co., Bessemer Blk., Pittsburg, secured the contract for the c.-i. pipe and for building a dam across Schmucker Run; it bid for 13,100 ft. c.-i. pipe $1.16; 2,630 ft. 6-in., 82 cts.; 125 cu. yds. masonry, $4.25, and 400 cu. yds. masonry, 60 cts.; total amount of contract, $18,319, which also includes valves and tees. The totals of the other bids received were as follows: C. A. Patterson, Williamsburg, $15,184; J. T. Finn & Co., Altoona, $21,481; Ross Metz Fay, Williamsburg, $22,696; Dechant & Wilson, Junita, $17,855; Herr. Dhrew & Co., Altoona, $18,695, and Thos. M. Oakes & Co., Huntingdon, $24,857. Engineers, Henry & Dillman, Altoona Trust Bldg., Altoona.

Lebanon, Pa.—Bids will be received until Nov. 16 by the Bd. of Comrs. (John N. Shaeffer, Clk.) for furnishing material and constructing water works for the Township of West Lebanon, Lebanon County, including 4, 6, 8 and 10-in. bell and spigot pipe, in all about 14,000 ft., roofed reservoir, 300,000 gals. capacity. Plans and specifications may be seen and proposal blanks obtained at the office of the engineer, 9th and Scull Sts., Lebanon, after Nov. 9.

**Portland, Ore.*—The following are the bids opened on Oct. 11 by the Water Bd. (*a*) 4,194 tons c. i. pipe per ton; (*b*) 166,000 lbs. specials per lb.; (*c*) totals: Martin Pipe & Fdy. Co., San Francisco, Cal. (*a*) $34.75; Oregon Iron & Steel Co., Portland (*a*) $35.30, (*b*) 3 cts., (*c*) $152,888 (awarded contract); United States Cast Iron Pipe & Fdy. Co., Chicago, Ill., (*a*) $36.75, (*b*) 3 cts., (*c*) $159,109.

The following are the bids opened same time and place for furnishing material and labor for the construction of a high-service main from Reservoir No. 1, Mt. Tabor, to a connection with present mains at Killingworth Ave. and Commercial St., a total approximate distance of 39,500 lin. ft.

Separate proposals were submitted as follows:

Proposal A—For furnishing steel plates and rivets required for 31,600 lin. ft. steel riveted pipe, 24 in. inside diam., approximate weight, 2,300,000 lbs. All to be delivered f. o. b. cars Portland: (1) 2,230,000 lbs. steel plates, per 100 lbs.; (2) 70,000 lbs. rivets per 100 lbs.; (3) total cost. Phoenix Iron Wks., Portland, (1) $2.30, (2) $3.25, (3) $53,565. Geo. C. Straw, Portland, (1) $2.35, (2) $3.15, (3) $54,610.

Proposal B—Totals for manufacturing and laying 31,600 ft. steel riveted pipe and specials, and completing same on or before July 1, 1906. Pipe to be 24 in. inside diam. Steel plates and rivets to be furnished by Water Bd. f. o. b. cars Portland. Paquet, Giebisch & Joplin, Portland, $72,119; Willamette Boiler Wks., Portland, $80,714; and Phoenix Iron Wks., $81,958. The lowest bidders, Paquet, Giebisch & Joplin, bid for this work, 31,600 lin. ft. straight pipe, $1.75; 65 manholes, ea. $34; 400 lin. ft. curved pipe, $3.40; 2,000 lin. ft. 6-in. blow-off pipe, 48 cts.; 50 cu. yds. concrete, $6; 30,000 cu. yds. excav. and refill, 35 cts.

Proposal C—Totals for furnishing material and labor required for the construction of 31,600 lin. ft. 24-in. steel riveted water main, in place: the entire work to be completed on or before July 1, 1906. Schaw, Batcher Pipe Wks., Sacramento, Cal., $122,635; Paquet, Giebisch & Joplin, Portland. $127,267; Risdon Iron & Locomotive Wks., San Francisco, Cal., $126,177; Harry Howard, Portland, $139,630; Pacific Bridge Co., Portland, $147,651; Robt. Wakefield, Portland, $146,131. The lowest bidder, Schaw-Batcher Pipe Wks., bid for this work: 31,600 lin. ft. straight pipe, $3.37½; 65 manholes ea. $20; 400 lin. ft. curved pipe, $4.75; 2,000 ft. 6-in. blow-off pipe, 60 cts.; 50 cu. yds. concrete, $6; 30,000 cu. yds. excav. and refill., 35 cts.

*Proposal D—For furnishing labor and laying 31,600 lin. ft. of 24-in. c. i. pipe and specials: (1) Paquet, Giebisch & Joplin, Portland, $28,620 (awarded contract), (2) International Contract Co., Seattle, Wash., $32,554, (3) W. O. Backus, Portland, $40,088, (4) J. B. Slemmons, Portland, $42,140.

	*1	2	3	4
31,600 lin. ft. 24-in. c. i. pipe (laying)	$.55	$.69	$.78	$.90
2,000 lin. ft. 6-in c. i. pipe (laying)	.17	.15	.22	..
50 cu. yds. concrete..........	6.00	7.00	10.00	10.00
2 acres clearing and grubbing..	50.00	100.00	50.00	200.00
30,000 cu. yds. excav. & refill..	.35	.33	.48	.40

Proposal E—Totals for furnishing labor and laying 5,400 lin. ft. 20-in. c. i. pipe and specials, and 2,500 lin. ft. of 16-in. c. i. pipe and specials. Paquet, Giebisch & Joplin, Portland, $5,915; Robt. Wakefield, Portland, $6,231; International Contract Co., Seattle, Wash., $6,737; Pacific Bridge Co., Portland, $6,300; W. O. Backus, Portland, $7,767; Harry Howard, Portland, $7,865; J. B. Clemmons, Portland, $9,120.

Hartsville, S. C.—H. A. Edwards, Mayor, writes that C. C. Wilson, of Columbia, is engineer in charge of the proposed water works and sewerage system.

Bristol, Tenn.—The Mayor and Bd. of Aldermen are reported to have decided to purchase the plant of the Bristol-Goodson Water Co., subject to a vote of the citizens.

Ballinger, Tex.—J. W. Powell, Mayor, writes that bids will be received from Nov. 20 to Dec. 1 for the construction of water works, to cost about $12,000.

**Jacksonville, Tex.*—W. W. Cook & Co., of Kansas City, Mo., are reported to have secured the contract for constructing water works (bids opened Oct. 10) for about $30,000.

**Floresville, Tex.*—Contracts for material for the water works are stated to have been awarded as follows: Boiler, pump, heater, air compressor, air receiver and compound pump to the Pratt Iron Wks., of Dayton, O., for $1,901; tank and tower to Harry Bros. Co., of Dallas, for $3,313; hydrants to Fairbanks Co., of New Orleans, La., for $2,375. Pipe will be furnished from the Rusk penitentiary.

**Ft. Ethan Allen, Vt.*—The two lowest bids opened on Oct. 19 by Capt. T. B. Lamoreux, Q. M., U. S. A., Burlington, Vt., for sinking two or three 8-in. tubular wells and piping same at Ft. Ethan Allen were submitted as follows: Artesian Well Supply Co., Providence, R. I., wells, $4 per ft.; testing, $19 per day. J. A. Williams, Burlington, Vt., wells, $3.50 ft. for 318 ft., $4 per ft. on 350 ft.; testing, $50 per day.

Chatham, Va.—The Town Council is stated to have adopted resolutions providing for an issue of $17,500 bonds for an increase of water supply, sidewalks, and to retire outstanding water bonds.

**Richmond, Va.*—The following are reported to be the bids received on Oct. 16 for the construction of a 5-ft. reinforced concrete conduit about 1 mile long and pipe connections with same: Thos. Barry & Co., $86,978; Shailer & McCormick, $79,341, and Crouse Constr. Co., of New York, $54,730 (recommended for award).

Piedmont, W. Va.—T. B. Davis, of Piedmont, writes that the Piedmont Water Works Co. has been organized to furnish money to the town with which to construct water works; probable cost $30,000. No engineer selected as yet.

Seattle, Wash.—The City Council on Oct. 16 passed ordinances providing for the construction of water mains on E. Prospect, 10th Ave. W., 6th Ave. W. and other streets, to cost in all about $59,180.

Tacoma, Wash.—Frank L. Davis, City Engr., writes that the Council has voted $10,000 with which to begin

**Items marked thus give the names of parties awarded contracts.*

surveys for a hydraulic water system of 30,000,000 gals. per day, costing approximately $1,500,000.

Olympia, Wash.—This city proposes to condemn present water works, and if it can be bought at a price for its real value, it will be done, otherwise the city will put in municipal water works. The matter will be submitted to a vote of the people. J. B. Weddell, City Engr.

Winnipeg, Man.—It is stated that bids will be received until Nov. 6 by the Fire, Water & Light Com. (J. C. Gibson, Chmn.) for a steel caisson, 15 ft. diameter and 43 ft. deep for a new well for the additional water supply. H. H. Ruttan, City Engr.

London, Ont.—The Water Comrs. are reported to have asked City Council for $251,000 for an extension of the water supply, to be used as follows: $100,000 for a second main from Springbank; $106,400 for purchase of springs, and $45,000 for additional city mains.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Woodlawn, Ala.—W. E. Perryman, Mayor, writes that bids will be received about Feb. 1 for the construction of a sewerage system, to cost about $20,000. Engineer, C. E. Brown, of Birmingham.

San Francisco, Cal.—Thos P. Woodward, City Engr., writes that plans have been prepared and bids will soon be called for sewers in Baker St. from Union St. to the Bay, estimated cost, $55,000; also in California St. from 24th Ave. to 31st Ave., estimated cost, $25,000. He further states with regard to sewer work that under the $724,800 sewer bond issue, $27,000 worth has been completed, construction is under way for $165,000, contracts are about to be let for $80,000, plans are almost finished for $300,000, and the balance will follow immediately. It is expected that in a few months $1,000,000 more of sewer and paving bonds will be sold.

San Jose, Cal.—Chas. H. Pieper, City Engr., has been authorized to prepare and present to the Mayor and Common Council an estimate of cost of improving and extending the sewerage system of the city.

**Hartford, Conn.*—Chas. H. Slocomb is stated to have secured the contract for building a vitr. tile sewer in Windsor St. (bids opened Oct. 18) for $6,372.

Boise City, Idaho.—Bids will be received until Nov. 6 by the Common Council at the office of J. A. Beal, City Clk., for constructing approximately 26,337 lin. ft. 8-in. and 1,600 lin. ft. 10-in. vitr. pipe sewers. Zenas M. Vaughn, City Engr.

Bloomington, Ill.—It is proposed to construct pipe sewers on Clinton and Grove Sts. and on Morris Ave. Elmer Folsom, City Engr.

Clinton, Ill.—Bids will be received until Nov. 7 by the Comrs., Clintonia Special Drainage Dist. (Dennis O'Dea, Chmn.) for furnishing and hauling material and constructing tile drain. Bids may also be submitted separately on the following: Furnishing tile and specials in quantities and sizes as required, f. o. b., Wapella, Ill.; digging ditch, laying tile, blinding and back-filling trenches; unloading and hauling the tile from the cars and distributing same when directed along the line of the work. Engineer's estimate: 20,951 ft., 22 to 14-in. vitr. salt-glazed tile. Excavations: 22-in. tile, average cut 7.81; 18-in., cut 6.46; 16-in., cut 7.26; 15-in., cut 6.45; 14-in., 5.05; 4 increasers; 72 "Y" junctions to fit the several sizes of tile used above. J. G. Melluish, Engr., 222 Unity Bldg., Bloomington.

Elgin, Ill.—The City Engr. is reported to be preparing estimates for sewers in the 4th Ward.

Waukegan, Ill.—Local press reports state that contracts will probably be let this fall for the construction of the north side sewerage system, to cost about $40,000 and the west side sewerage system to cost about $75,000.

Tipton, Ind.—It is reported that bids will be received until Nov. 7 by O. C. Duncan, Co. Surv., for constructing about ¾ mile of the Wm. Webb ditch; the tile ranging from 15 to 18 in.

Indianapolis, Ind.—Bids will be received until Nov. 1 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for constructing a 24-in. main sewer along the north bank of Fall Creek, Pennsylvania and 28th Sts.; also a brick or concrete main drain along the east bank of the canal to vary in size from 3 ft. to 2 ft. 6 in. in diameter.

Lawrence, Kan.—It is reported that bids will be received until Nov. 6 at the office of F. D. Brooks, City Clk., for furnishing material and constructing a lateral sewer in Adams St.

Georgetown, Ky.—J. H. Keller, Mayor, writes that the survey has not yet been made for the proposed sewerage system and it will probably be next spring before bids for construction will be invited. Engineer, John W. Alvord, Chicago, Ill. It was previously reported that John B. Graves secured the contract for constructing this system, but a later report states that he purchased the bonds, the proceeds of which will be used for the construction of a sewerage system.

Baton Rouge, La.—Bids will be received by the Bd. of Pub. Wks. until Nov. 30 for the construction of a separate system of sewerage, as advertised in The Engineering Record. B. Swart, City Engr.

Abbeville, La.—See "Water."

Saginaw, Mich.—The Bd. of Estimate has approved the issue of $10,000 sewer bonds for the West Side, and $15,000 street improvements for the East Side.

**Jackson, Mich.*—Tobin & Co., of Chicago, Ill., is reported to have secured the contract for constructing the purification plant and intercepting sewer (bids opened Oct. 12) for $29,961.

Lake City, Minn.—Bids will be received until Oct. 31 by the Common Council for constructing an 8-in. sewer in a portion of Elm St. A. W. Corwin, Recorder.

Fairmont, Minn.—All bids opened on Oct. 13 for the construction of a sewerage system for Fairmont are stated to have been rejected, being considered too high. The lowest bid received was submitted by W. D. Lovell, of Minneapolis, for $17,081.

St. Paul, Minn.—Bids will be received until Nov. 2 by the Bd. Pub. Wks. (R. L. Gorman, Clk.) for constructing sewers in a portion of W. Delos St.

Webb City, Mo.—Bids will be received by W. E. Smith, City Engr., until Nov. 20, for the construction of a sewer in Sewer Dist. No. 10, to consist of 1,710 ft. 8-in. sewer, 110 6-in. Y branches, 2 lampholes, 4 manholes and 1 flush tank, as advertised in The Engineering Record.

Norfolk, Neb.—John Friday, Mayor, writes that it is proposed to construct a sewerage system, at a cost of $50,000. Engineer, Edw. Rosewater, of Omaha.

Orange, N. J.—A proposition is reported to have been presented to the Orange Common Council, providing for the establishment of a sewage disposal plant at Belleville, at a cost of $10,000.

**Jersey City, N. J.*—Geo. T. Bouton, Clk. Bd. St. and Water Comrs., writes that J. H. & R. Shannon Co, 538 Bergen Ave., have secured the contract for 500 ft. of 36-in. circular brick supplemental sewer (bids opened Oct. 7) at 103 per cent. of standard price.

*Henry Byrne, 169 Summit Ave., secured the contract for constructing a main outlet sewer in Pamrapo Ave. (bids opened Oct. 23) at 99 per cent. of the standard price. This work includes 300 lin. ft. 72-in., 382 lin. ft. 66-in., 338 lin. ft. 63-in., and 580 lin. ft. 57-in. steel pipe sewer; 785 lin. ft. 36-in. circular brick sewer; 1,000 cu. yds. rock excav.; 100 cu. yds. concrete, etc.

*Chas. Ormsby, 3146 Hudson Boule., has secured the contract for constructing a sewer in Collard St. (bids opened Oct. 23) at 95 per cent. of the standard cost. This work includes 1,130 lin. ft. 30-in. oval brick sewer; 470 lin. ft. 24-in. brick circular sewer; 1,076 lin. ft. 18-in. vitr. pipe sewer; 900 cu. yds. rock excav.; 10 receiving basins, etc.

All bids opened Oct. 23 by the Street and Water Comrs. (Geo. T. Bouton, Clk.) for the construction of Van Winkle Ave. sewer have been rejected, and new bids will be received.

Paterson, N. J.—Bids will be received by the Com. on Streets and Sewers of the Bd. Aldermen, on Nov. 3, for constructing 3,825 ft. 12-in. and 1,375 ft. 18-in. pipe sewers in portions of 6 streets. H. J. Harder, City Engr.

**Cape May City, N. J.*—De Witt D. Barlow, City Engr., writes that the contract for constructing a portion of the sewerage system (bids opened Oct. 16) has been awarded to M. J. Hogan & Co., Real Estate Trust Bldg., Philadelphia, for $59,913. For detail bids received for this work, see issue of The Engineering Record Oct. 21.

New York, N. Y.—Bids will be received until Oct. 31 by Louis F. Haffen, Pres. Boro. Bronx, for constructing sewers and appurtenances in portions of several streets. Engineer's estimate: 8,900 lin. ft. 18, 15, 12 and 6-in. pipe sewer; 32 manholes, complete; 2,250 cu. yds. rock excav.; 12,000 ft. B. M. of timber for foundations furnished and laid, and sheeting furnished and left in place; 120,000 ft. B. M. timber; 20,000 lin. ft. piles; 62,900 lbs. 1-in. and 8,100 lbs. ½ in. steel bars; 2,000 sq. ft. expanded metal, etc.

**New York, N. Y.*—Thos. J. McLaughlin, 30 Park Row, has secured the contract for altering and improving sewer in W. 71st St., bet. Bway. and Columbus Ave., at a total cost of $11,601. He bid for 892 lin. ft. 3 ft. 6 in. x 2 ft. 4 in. sewer, $9.20; 500 cu. yds. rock excav., $4, and 45 M. ft. timber $31.

Buffalo, N. Y.—Bids will be received until Nov. 1 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for constructing tile sewers. Bids to be submitted separately on each of the following streets: Dunston Ave., 18, 15 and 12-in.; Theodore St., 15, 12 and 10-in.; Zelmar St., 15, 12 and 10-in.; Robert St., 18 and 15-in.; Sears St., 12-in.; Margaret St., 12-in.; also in Argus and Zinn Aves. and Teutsch St., a 24-in. brick, 20 and 10-in. tile sewer.

**Lake City, Fla.*—The following are the bids opened on Oct. 20 by the Board of Bond Trus. for the construction of a sewerage system: (*a*) F. H. Beeman, Louisville, Ky.; (*b*) Fred. Minshall, Abbeville, S. C.; (*c*) J. H. Harris, Jacksonville; (*d*) A. L. Patterson & Co., Macon, Ga.; (*e*) Ebaugh & Ebaugh Greenville, S. C.; (*f*) Bryan & Co., Jacksonville (awarded contract). Wm. W. Lyon, Consulting Engr., Palatka.

	a	*b*	*c*	*d*	*e*	**f*
Trenching—						
8,075 ft. under 4 ft.	$0.16	$0.18	$0.12	$0.17	$0.19	$0.13
12,540 ft. under 6 ft.	.24	.25	.20½	.20	.26	.17
9,700 ft. under 8 ft.	.35	.70	.26½	.40	.40	.33
5,747 ft. under 10 ft.	.48	1.05	.48	.80	.60	.56
500 ft. under 12 ft.	.85	1.50	.72	1.10	1.25	.78
500 ft. under 14 ft.	..	2.00	1.00	1.45	1.50	1.04
525 ft. under 16 ft.	..	2.50	1.00	2.95	1.85	1.50
Pipe—						
12,816 ft. 6-in.	.12	.10	.27	.11	.13	.10
15,595 ft. 8-in.	.16	.14	.36½	.15	.18	.15
4,390 ft. 10-in.	.21	.20	.53	.22	.25	.21
4,340 ft. 12-in.	.28	.26	.65½	.30	.34	.28
Pipe Specials—						
250 6in.	.20	.26	.45	.27	.30	.40
320 8-in.	.31	.31	.57	.30	.45	.60
88 10-in.	.40	.60	.68	.42	.62	.85
44 12-in.	.51	.70	.89	.70	.85	1.25
Manholes—						
17 under 4 ft.	29.00	28.00	43.20	27.00	25.00	25.00
29 under 6 ft.	35.00	32.00	46.20	31.00	27.50	27.50
40 under 8 ft.	39.00	36.00	49.20	35.00	32.00	30.00
27 under 10 ft.	43.00	41.00	52.20	40.00	37.50	35.00
2 under 12 ft.	47.00	47.00	55.20	45.00	45.00	40.00
1 under 14 ft.	50.00	54.00	58.20	55.00	50.00	45.00
1 under 16 ft.	....	65.00	....	65.00	55.00	50.00
21 flush tanks	64.00	70.00	92.00	65.00	60.00	60.00
1 lamphole	8.00	8.00	10.80	8.00	15.00	12.50
Totals	$22,982	$31,830	$32,533	$26,851	$26,811	$22,293

Leeds, N. D.—Engineer Paul C. Gorder is reported to have prepared estimates for the construction of sewers at this place.

Oklahoma City, Okla. Ter.—See "Water."

**Williamsport, Pa.*—Jas. F. Fisher, City Engr., writes that bids were opened on Oct. 12 by the Highway and Sewer Com. for the construction of the Park Ave. storm sewer. Bids were submitted on three different plans, A, B and C; also on concrete and brick: (1) concrete, (2) brick: Guise Brick & Sewer Co., (1) Plan A, $39,861; (1) Plan B, $40,919 (1) Plan C, $38,329; (2) Plan A, $40,034; (2) Plan B, $41,217; (2) Plan C, $38,759. Coryell Constr. Co., (1) Plan A, $36,284; (1) Plan B, $37,482; (1) Plan C, $34,972 (awarded contract); (2) Plan A, $39,038; (2) Plan B, $39,336; (2) Plan C, $38,163. Lycoming Constr. Co., (1) Plan A, $37,965; (1) Plan B, $40,555; (1) Plan C, $37,965; (2) Plan A, $37,660; (2) Plan B, $40,250; (2) Plan C, $37,660 (bidders all of Williamsport).

*The contract for the construction of the Park Ave. sewer was awarded on Plan C for concrete, to the Coryell Constr. Co., and the following are detail bids received on this plan: (*a*) Guise Brick & Sewer Co.; (*b*) Coryell Constr. Co. (awarded contract); (*c*) Lycoming Constr. Co.:

	a	**b*	*c*
515 ft. 7.5 ft. x 4.5 ft. concrete	$12.00	$12.00	$11.00
1 manhole	45.00	45.00	50.00
860 ft. 5-ft. concrete	8.00	8.90	8.00
2 manholes	40.00	42.00	45.00
1,750 ft. 4-ft. concrete	5.50	4.05	6.00
3 manholes	40.00	40.00	40.00
870 ft. 3.5-ft. concrete	4.60	3.15	5.00
2 manholes	30.00	36.00	38.00
880 ft. 3-ft. concrete	4.25	3.75	2.90
2 manholes	30.00	37.50	38.00
735 ft. 18-in. T. C. pipe	2.00	1.25	1.75
1 manhole	30.00	38.00	40.00
1,000 cu. yds. excav.	.50	.60	.60
5,000 ft. 10-in. underdrain	.40	.50	.40
10 M. ft. lumber	20.00	30.00	20.00
100 cu. yds. concrete	6.00	6.00	6.00
100 cu. yds. brick work	9.57	10.00	10.00
500 ft. catch basin constr.	.65	.60	.70
100 ft. 6-in. house sewer connection	.40	.50	.40
10 inlets	30.00	30.00	30.00
Terra Cotta Pipe—			
100 ft. 24-in.	2.40	2.50	2.50
100 ft. 15-in.	1.25	1.10	1.60
250 ft. 12-in.	1.14	.85	1.20
300 ft. 10-in.	.85	.75	.90
300 ft. 8-in.	.70	.70	.70

West Chester, Pa.—Herbert Snow, of Boston, Mass., is reported to have been selected by this borough to offer suggestions as to the best method of disposal of its sewage.

Norristown, Pa.—The following are the bids opened on Oct. 10 for the construction of sanitary sewers and laterals:

*Arch St. sewer: John H. Dyer, of Norristown, secured contract at $1,353 per lin. ft. for 30,892 ft. main sewer; 97 cts. per lin. ft. for 11,714 lin. ft. laterals; $125 and $97 ea. for flush tanks; total $56,168. The other bids received for this street were: T. E. Vermilye, 50 Stewart Bldg., New York, N. Y., $76,290, and E. S. Seeds, Philadelphia, $57,298.

*Markley St. sewer: E. L. Seeds, Philadelphia, secured contract at $1.44 per lin. ft. for 15,670 ft. main sewer; 75 cts per lin. ft. for 10,000 lin. ft. laterals; and $100 and $125 for ea. flush tank; total cost, $32,316. The other bidders were: John T. Dyer, Norristown, $34,986, and T. E. Vermilye, New York, N. Y., $59,289

*Contracts for sewers on other streets were awarded as follows: To E. L. Seeds (Germantown) Philadelphia: For 12 streets a total of $30,285, and to John T. Dyer, of Norristown, 8 streets, for a total of $18,924.

Hartsville, S. C.—See "Water."

Seattle, Wash.—The City Council on Oct. 16 passed an ordinance providing for the construction of sewers on 11th N. E., 12th N. E., 25th, Federal and 21st Aves. and adjoining avenues, to cost in all about $24,650.

**Parkersburg, W. Va.*—J. V. Dunbar, City Engr., writes that John W. Curry, of Parkersburg, has secured the contract for constructing sewers (bids opened Oct. 11) at the following bid: 9,000 cu. yds. excav., 43 cts.; 1,268 cu. yds. brick masonry, $7.90; 1,268 cu. yds. brick masonry, Spilman block, $7.50; 30 cu. yds. first-class stone masonry, $9; 18 cu. yds. concrete, $18; 1 special manhole, 23 ft. deep, $125; 5 special manholes, $30; 18 catch basins, ea., $18; 360 ft. 12-in. sewer pipe, 65 cts. Total cost, $15,173. Saml. Keenan bid also for this work $15,933.

**Fond du Lac, Wis.*—J. Rasmussen, of Oshkosh, has secured the contract for constructing 11,140 ft. pipe sewers 8 to 27-in. diam. (bids opened Oct. 7) for $14,840. G. H. Stanchfield, City Engr.

**Peshtigo, Wis.*—C. H. Nerton is reported to have secured the contract for constructing the sewer from the asylum to Beebe Ave., for $4,496.

Brantford, Ont.—Willis Chipman, of Toronto, is stated to have completed and presented to City Council his report on the construction of a system of surface drainage in this city. He estimates the cost at $200,000.

BRIDGES.

Notes Arranged Alphabetically by States.

Ukiah, Cal.—It is stated that bids will be received until Nov. 3 by the Bd. Superv. for constructing a bridge across Indian Creek.

Ventura, Cal.—It is stated that bids will be received until Nov. 9 by the Bd. Superv. for constructing bridges across Ventura River.

San Bernardino, Cal.—W. L. Brown, City Engr., writes that the city expects to call for an issue of $40,000 bonds to build 15 new bridges and cement culverts.

Waukegan, Ill.—The construction of a concrete bridge to replace the S. Genesee St. structure is reported under consideration, probable cost $70,000.

Tipton, Ind.—It is stated that bids will be received until Nov. 6 by the Co. Comrs. for constructing 2 bridges or arches in Jefferson Township. T. W. Longfellow, Co. Aud.

South Bend, Ind.—It is stated that bids will be received until Nov. 6 by the Bd. Co. Comrs. for building the concrete substructure and removing the Jefferson St. Bridge

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**Items marked thus give the names of parties awarded contracts.*

to Springbrook Park, over the St. Joseph River; probable cost, $26,000. W. J. Harton, Co. Aud.

Boston, Mass.—Bids will be received until Nov. 2 by Wm. Jackson, City Engr., for constructing the steel superstructure of Brookline St. Bridge, Boston to Cambridge.

Cambridge, Mass.—Bids will be received until Nov. 1 by L. M. Hastings, City Engr., for furnishing and placing filling and ballast at the approach to the Brookline St. Bridge, Cambridge, requiring 23,500 cu. yds. earth filling.

Jefferson City, Mo.—It is stated that bids will be received until Nov. 9 by the Co. Comrs. for constructing a steel bridge about 4 miles from Jefferson; estimated to cost $4,000.

Hoosick Falls, N. Y.—Bids will be received until Nov. 4 by the Town Clk., at Hoosick Falls, for building abutments, parapet and retaining walls, together with the necessary excavation and filling at the Stone School House bridge near the village of Hoosick, as advertised in The Engineering Record.

Beaufort, N. C.—See "Railroads."

Fargo, N. D.—It is stated that bids will be received until Nov. 7 by Arthur G. Lewis, Co. Aud., for constructing an 80-ft. bridge on line between Traill and Cass Counties.

**Cleveland, O.*—The Big Four Ry. Co. (G. W. Kittredge, Ch. Engr., Cincinnati) is reported to have awarded contracts for erecting 3 concrete bridges at various points along its line. A double track concrete bridge over the Miami River, near Dayton, replacing the present single-track bridge, the structure to consist of 6 piers. Another bridge will be erected 3 miles south of Miamisburg, and another 3 miles north of Middletown. The 2 bridges will consist of 7 piers and will be of concrete construction. The general contracts for all 3 bridges have been awarded to the Williams Bros. & Morse Co., of Cleveland, for about $100,000.

Miamisburg, O.—T. J. Kauffman, Co. Aud., Dayton, writes that the contract for constructing a bridge at Kercher St. (bids opened Oct. 21) has been awarded to J. C. Morrison, of Dayton, for $2,430.

Doylestown, Pa.—Press reports state that bids will be received until Nov. 20 by the Bd. Co. Comrs., for constructing a stone arch bridge over the Haycock Run near Bucksville.

Philadelphia, Pa.—We are informed that no date has yet been set for the receiving of bids for the proposed bridges to be constructed and paid for from the proposed $16,000,000 loan.

**San Juan, Porto, Rico.*—J. J. Jimenz, Supt. Pub. Wks. Dept. of the Interior of Porto Rico, writes that the U. S. Products Export Co., of New York, N. Y., has secured the contract for constructing a 266-ft. span highway bridge for $10,579 and the Penn Bridge Co., of Beaver Falls, Pa., secured the contract for a 100-ft. span highway bridge for $5,358 (bids opened Sept. 30).

Greenville, S. C.—It is stated that bids will be received until Nov. 1 by John W. Walker, Superv. Greenville County, Greenville, and G. M. Lynch, Superv. Pickens County, Pickens, for rebuilding Mayfield's Bridge over South Saluda River.

Memphis, Tenn.—The date of opening of bids for the construction of two 50-ft. span steel highway bridges on concrete piers, one 20-ft. span steel highway trestle, and the raising of 227 ft of steel truss highway bridge, bids for which were to have been opened on Nov. 6 by the Shelby County Levee Comn., has been extended to Nov. 20, as advertised in The Engineering Record.

Welcome, Wash.—It is reported that bids will be received until Nov. 8 by the Co. Auditor at Bellingham for constructing a steel bridge across the Noosack at Welcome, to replace the present wooden bridge; probable cost, $7,500.

Elizabeth, W. Va.—T. A. Brown, of Elizabeth, writes that the West Fork Bridge Co. has been organized to construct a bridge across West Fork River near its mouth connecting West Fork and Creston. Contract for construction not yet let.

**Milwaukee, Wis.*—B. E. Sivyer is reported to have received the contract for constructing section 3 of the Washington Ave. Viaduct for $5,287.

Racine, Wis.—The Council is stated to have on Oct. 17 directed the Scherzer Rolling Lift Bridge Co. to prepare plans and specifications for a lift bridge to be constructed over Root River, at Main St., the cost not to exceed $72,000.

Portage, Wis.—Bids will be received until Nov. 7 by the Common Council for constructing the superstructure of a steel highway bridge across Wisconsin River, consisting of 4 spans of 160 ft., with a 24-ft. brick roadway and a 6-ft. walk. Plans and specifications may be obtained on a deposit of $5. L. P. Wolff, Con. Engr., First Natl. Bank Bldg., St. Paul, Minn.; D. A. Hillyer, City Clk.

**Ottawa, Ont.*—C. Macnab, Co. Clk., writes that the Steel Concrete Bridge Co., of Montreal, Que., has secured the contract for constructing a bridge over Rideau River, for about $20,000.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

**Columbus, Ga.*—The Southern Bitulithic Co., of Nashville, Tenn., is stated to have received the contract for paving with bitulithic, about 15,000 sq. yds., on Broad St., at $1.87 per sq. yd. (bids opened Oct. 3).

Centralia, Ill.—Bids are wanted Oct. 31 for 94,631 sq. yds. brick paving; 33,688 cu. yds. excav.; 766 cu. yds. fill; 50,139 lin. ft. stone curb; 2,585 lin. ft. oak headers, and 2,549 lin ft stone headers. Engineers, Iowa Eng. Co., of Clinton, Ia.

Indianapolis, Ind.—Bids will be received until Nov. 1 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for grading, graveling and rolling the roadway on portions of 11th, Nelson and New Jersey Sts.; also paving with cement the sidewalks on portions of Division and La Salle Sts.

Franklin, Ind.—It is stated that bids will be received until Oct. 31 by Arthur R. Owens, City Clk., for cement sidewalk improvement on the west side of S. Horne Ave. Otis B. Sellers, City Engr.

Terre Haute, Ind.—Petitions have been filed with the Bd. of Pub. Wks. for about 9 miles of brick paving.

**Atchison, Kan.*—The contract for paving U St. with brick, 1,778 sq. yds., has been awarded to L. Wines, of Atchison, for total bid $3,053, and the contract for paving Commerce St. with macadam, 9,470 sq. yds., to J. H. Tietze, Atchison, for $8,448 (bids opened Oct. 14).

**Hutchinson, Kan.*—T. G. Elbury, City Engr., writes that the Kansas Bitulithic Paving Co. has secured the contract for paving certain streets in this city with bitulithic.

Atchison, Kan.—Resolutions have been adopted for the paving of Alleys in blocks Nos. 65 and 78 with vitrified brick, about 1,056 sq. yds.

Baton Rouge, La.—Bids will be received by the Bd. of Pub. Wks. until Nov. 30 for paving portions of 15 streets, as advertised in The Engineering Record. The approximate quantities are 53,941 sq. yds. paving and 30,835 lin. ft. combined curb and gutters, and bids are wanted on Warren's bitulithic pavement, any other bitulithic pavement, asphalt and vitrified brick on a concrete base. B. Swart, City Engr.

Centerville, Md.—It is reported that bids will be received until Oct. 31 by the Co. Comrs. for furnishing material and constructing about 1½ miles of road, including building of bridges and drains. Jos. M. Parvis, Clk.

**Dracut, Mass.*—The following are the bids opened by the State Highway Comn., at Boston, Mass., Oct. 18, for constructing State highway in Dracut: Dan'l E. Lynch, Dorchester, $6,342; John A. Gaffey, Medford, $6,136; Lane Constr. Co., Meriden, Conn., $5,547; L. C. Carchia, Boston, $5,347, and M. L. Camarco, Lee, $5,281 (awarded contract).

Saginaw, Mich.—See "Sewerage and Sewage Disposal."

**Lansing, Mich.*—The Murray Co., of Saginaw, has secured the contract for constructing 2 miles of macadam road on Michigan Ave., from Lansing to the Agricultural College, for $13,850. The road will be 23 ft. wide between gutters, the central 15 ft., of which will contain 6 in. of compacted macadam.

**Manistee, Mich.*—The contract for the clearing and grading of Section 21 of the Copenish branch of the Manistee County Road has been awarded to John Joseph for $3,240. It is 1½ miles in length and requires the removal of about 19,000 cu. yds. of material.

St. Paul, Minn.—Bids will be received until Nov. 2 by the Bd. Pub. Wks. (R. L. Gorman, Clk) for macadamizing a portion of Maria Ave.

Duluth, Minn.—Lang & Preston are stated to have submitted the lowest bid for paving with sandstone block on a portion of 5th Ave., for $4,390.

Gulfport, Miss.—The City Council is stated to have passed a resolution providing for the issue of $25,000 street improvement bonds.

**Indianola, Miss.*—W. B. Gresham, Clk. Town Bd., writes that the contract for paving sidewalks with concrete has been awarded to Rudolph S. Blome Co., of Chicago, Ill.

Webb City, Mo.—Bids will be received by W. E. Smith, City Engr., until Nov. 20, for grading and graveling Oronogo St., about 2,052 ft., as advertised in The Engineering Record.

Hannibal, Mo.—It is stated that bids will be received until Nov. 6 by S. A. Birch, City Clk., for constructing concrete or granitoid walks on Palmyra Ave.

Kirksville, Mo.—Bids will be received by the Mayor and City Council until Nov. 6 for grading and paving with vitrified brick on 6-in. cement concrete foundation, and curbing with cement concrete 6 x 24-in. in parts of Washington, Elson, Harrison and Franklin Sts., as advertised in The Engineering Record.

West Hoboken, N. J.—Sebastian Maulbeck, Town Surveyor, writes that bids are about to be asked for paving Traphagen St. with Belgian block, at a cost of $1,400 and for paving Stevens St. with brick at a cost of $7,000.

Perth Amboy, N. J.—It is stated that bids will be received until Nov. 6 by the City Council for paving Rector St. from Market to Smith Sts., with 12-in. telford macadam pavement and 2 ft. of Belgian block gutter stone on each side. Wm. Fullerton, Street Comr.

Verona, N. J.—Bids will be received until Nov. 8 by the Township Clk. for constructing flagstone sidewalks and all necessary crosswalks on portions of Bloomfield Ave., bids to be submitted separately on the sidewalks and crosswalks. F. W. Crane, Township Engr., Montclair, N. J.

**Jersey City, N. J.*—The Barber Asphalt Co. has secured the contract for paving Bergen Ave. with asphalt (bids opened Oct. 23 by the Bd. of Street and Water Comrs.) at 87⅖ per cent. of the standard cost. The work includes 11,460 sq. yds. asphalt; 400 lin. ft. stone curb, 5 x 16 in., set in concrete; 2,500 yds. earth excav.; resetting 23 manhole heads, 1 new manhole, etc.

New York, N. Y.—Bids will be received until Oct. 31 by Louis F. Haffen, Pres. Boro. Bronx, for regulating, grading, curbing, paving, repaving, laying sidewalks, etc., on portions of several streets. Engineer's estimate: 7,425 sq. yds. completed wood blk. pavt., and keeping same in repair for 5 years from date of acceptance; 5,870 sq. yds. completed asphalt pavt., including binder course and keeping same in repair for 5 years from date of acceptance; 1,820 sq. yds. new granite block pavt., laid with paving cement joints, and keeping same in repair for 5 years from date of acceptance; 50,300 sq. ft. new flagging, furnished and laid; 14,600 lin. ft. new curb, furnished and laid; 1,650 cu. yds. dry rubble masonry, in retaining walls, culverts and gutters; 2,490 cu. yds. concrete, including rubble masonry; 10,200 cu. yds. rock excav.; 16,480 cu. yds. earth excav.; 7,200 cu. yds. filling, etc.

East Hampton, L. I., N. Y.—The citizens are stated to have voted to issue $100,000 bonds for constructing good roads.

Buffalo, N. Y.—Separate bids will be received until Nov. 3 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for paving portions of Lord, Scott and Alabama Sts.

H. P. Burgard is stated to have submitted the lowest bid Oct. 19 for paving and repaving with asphalt portions of Tonawanda St., bidding $7,000 for the former and $14,250 for the latter contract.

Wilmington, N. C.—Bonds amounting to $50,000 for road improvements in New Hanover County are reported sold.

**Ashland, O.*—F. L. Niederheiser, City Engr., writes that the city contract for paving and curbing Sandusky St. (bids opened Oct. 17) has been awarded to Phillips & Arnold, of Ashland, for $9,982.

**Cincinnati, O.*—Henkel & Sullivan, Bodmann Bldg., have secured the contract for paving Warsaw Ave. with bitulithic (bids opened Oct. 18) for $73,232. The Barber Asphalt Co. secured the contract for paving Bauer Ave. with asphalt 2,930 sq. yds. for $8,017 (bids opened Oct. 18).

*The contract for macadamizing Ashland Ave. (bids opened Oct. 24) has been awarded to J. Delaney, of Cincinnati, for $9,868.

The Bd. Pub. Service is stated to have on Oct. 17 awarded the following contracts: portion of Fairfax Ave. with bitulithic, Warren Bros. Co., $43,625; Mound St. with bitulithic, Kirchner Constr. Co., $30,029.

The City Engineer is stated to have estimated the cost of paving a portion of Sherman Ave. with asphalt at $14,890; also a portion of Moormann Ave. with bitulithic at $15,200.

Cleveland, O.—Bids will be received until Nov. 11 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.) for grading, draining and paving with brick, a portion of Coe Ridge Road.

*The contract for paving Aberdeen St. with brick, 2,078 sq. yds. (bids opened Oct. 4) has been awarded to Geo. B. Herring & Son, 444 Cedar Ave.; total bid, $3,893.

Springfield, O.—The following bids are reported to have been opened Oct. 12 by Bd. Pub. Service for paving a portion of Factory St. with brick: Chas. Bird, $1.70; W. F. Payne, $1.55, and J. F. McClure, $1.69.

**Toledo, O.*—Kerlin Bros., 410 Nasby Bldg., are stated to have received the contract for paving a portion of Lincoln Ave. with Logan block or broken stone for $8,203.

**Marysville, O.*—The contract for paving with asphalt W. 4th St. is reported to have been awarded to the Barber Asphalt Paving Co., of Cleveland, at $1.75 per sq. yd.

**Galion, O.*—A. J. Stough is stated to have received the contract for paving S. Market St. extension with Massillon block for $4,990.

Lancaster, Pa.—The following are reported to have been the bids opened Oct. 16 by the Street Com.: For the removal of about 7,150 sq. yds. of Belgian block and for the substitution therefor of asphalt sheeting, wooden blocks, or Warren Bros. bitulithic pavements on Centre Square, and a portion of N. Queen St. (price given per sq. yd.): Barber Asphalt Co., asphalt sheeting, $1.79; Filbert Paving & Constr. Co., asphalt sheeting, $1.78; Standard Bitulithic Co., bitulithic paving, $2.20; J. U. Fritchey & Son, wooden block, $2.74; United States Wood Preserving Co., wooden blocks, $2.75.

Nashville, Tenn.—It is stated that work will soon begin on the paving of streets with macadam, bonds for which to the amount of $125,000 were recently sold. In all about $500,000 bonds will be sold for paving, $125,000 each year.

Chatham, Va.—See "Water."

Seattle, Wash.—The City Council on Oct. 16 passed ordinances providing for grading of 30th, 31st. and 32d Aves., 3d N. W., 27th S., 10th W. and other avenues, at a total cost of $48,200; concrete walks on 6th N., 31st S., 24th N., 31st, 32d, 19th S., 37th and Harvard Aves. and E. Queen Anne driveway and other streets, to cost $73,430; asphalt paving on 14th Ave. and other streets, to cost $31,500, and brick paving on Prefontaine Pl. and on King St. and other streets, at a cost of $199,500.

Bids will be received by C. B. Bagley, Secy. Bd.. of Pub. Wks., until Nov. 4, for constructing concrete sidewalks on East Queen Anne Driveway; estimated cost, $25,900.

Spokane, Wash.—The following bids are stated to have been opened by the Bd. Pub. Wks. on Oct. 20 for *a* sidewalking with asphalt, Washington St.; *b* grading, curbing, parking and sidewalking Cannon St.; *c* grading, curbing and parking, N. Crescent Ave.: Barber Asphalt Paving Co., *a* $11,168; Jas C. Broad, *b* $5,465, *c* $3,265; J. H. McAllister, *b* $5,448, *c* $2,975; Mitchell Bros., *b* $4,840, *c* $3,200, and Peter Costello, *b* $5,000, *c* $3,000.

*J. H. Fife, S. 18 Chandler St., is reported to have received the contract (bids opened Sept. 14) for grading, curbing, parking and constructing sidewalks on a portion of 6th Ave., for $4,970.

Green Bay, Wis.—W. W. Reed, City Engr., writes that it is proposed to pave Main, Washington and Pine Sts., at a cost of about $120,000. Material not yet decided upon. Will probably be brick or asphalt.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Gravette, Ark.—G. W. Dunbar, of Gravette, is reported interested in the construction of an electric light plant, street railway and water works.

Pasadena, Cal.—It is reported that the Valley Electric Co. has been incorporated with a capital of $500,000. Incorporators: R. F. Davis, E. A. Miller, of Pasadena, and others.

Dover, Del.—The Metropolitan Gas & Electric Co., of Chicago, Ill., has been incorporated at Dover, Del., with a capital of $12,000,000, to furnish natural and artificial gas. Incorporators: Jos. Markley and Geo. F. Goodnow, of Chicago, Ill., and Harry W. Davis, of Wilmington, Del.

Washington, D. C.—Bids will be received until Nov. 7 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the Navy Yards, etc., Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 189, Pipe fittings and valves; Schedule 191, motor, electric wire, cable, plumbers' pumps, drills, etc.; Schedule 193, reamers, drills, Morse sleeves and sockets, brass, iron, copper, steel, billy pumps, etc.;

**Items marked thus give the names of parties awarded contracts.*

Schedule 194, pipe and fittings, expansion joints, valves, gauges, etc. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster Gen., U. S. N.

Sparta, Ga.—It is reported that the citizens have voted in favor of issuing $12,000 bonds to establish an electric light plant.

Tallapoosa, Ga.—E. A. Latimer, City Clk., writes that the citizens voted Oct. 16 to issue bonds for the construction of an electric light plant.

Chicago, Ill.—The City Council on Oct. 23 passed a resolution authorizing the Comr. of Pub. Wks. and City Electrician to prepare estimates of cost of securing electric energy from the water power of the drainage canal; also authorizing the Finance Com. to make the necessary appropriation for use of this power.

Paris, Ill.—It is reported that the Paris Gas & Electric Co. has been reorganized with Wm. Hunter of Paris as Pres. and J. C. Shumway of Taylorville, Secy., and will issue $20,000 bonds to make improvements.

Independence, Ia.—The city officials are said to be considering improving the water works and electric light plants.

Geary, Kan.—The Geary Electric Light & Power Co., it is reported, has been incorporated with a capital of $5,000. Directors: Chas. F. Dyer, I. J. Robb and J. M. Robb, all of Bridgeport.

Newport, Ky.—It is reported that the Municipal Light, Power & Fuel Co. has been incorporated with a capital of $200,000. The company has a franchise to supply gas to Newport. Incorporators: Harvey Myers, Jas. H. Young and B. Bramlage.

**Baltimore, Md.*—Peet, McInerny & Co., of New York, N. Y., have secured the contract for the installation complete of the conduit and electric wiring system for the U. S. Custom House at Baltimore (bids opened Sept. 27) for $12,437.

Leominster, Mass.—H. D. Jackson, of Boston, it is reported, has been engaged to superintend the improvements which the Massachusetts Lighting Co. intends making to the plant of the Leominster Electric Light & Power Co., on Mechanic St.

Springfield, Mass.—The Springfield Gas Light Co., of Springfield, it is stated, has petitioned the Gas & Electric Light Comn. at Boston for permission to increase its capital from $700,000 to $900,000, a portion of the money to be used to carry on new construction, extend the lines, improvements, etc.

Quincy, Mass.—The City Council has been petitioned to establish a municipal gas and electric lighting plant.

Manistee, Mich.—The Manistee River Power Co. (Wm. Douglas, Manistee, Pres.) has petitioned for permission to dam the river near Sherman and erect a power house about 1 mile east of that village. Traverse City, Manistee and Cadillac, it is stated, are to be furnished light and power and the plant is to be capable of developing 3,000 h.p. A meeting of the Bd. of Superv. is to be held on Nov. 15 at Cadillac to consider the petition.

Muskegon, Mich.—It is reported that the Grand Rapids & Muskegon Electric Water Power Co. has petitioned for a franchise to furnish the city with electric light and power.

Delray, Mich.—It is reported that the gas plant is to be enlarged by the Cleveland owners, a bond issue of $300,000 having been authorized for that purpose.

Starkville, Miss.—Bonds to the amount of $8,000 are reported sold to be used for extending the water and light plant.

Meredith, N. H.—The plant of the Meredith Electric Light Co., it is reported, has been purchased by the Laconia Electric Light Co. (C. P. Longee, Supt. & Ch. Engr., Laconia) and the power station here, it is stated, is to be discontinued in the near future. It is said to be the intention of the new management to extend the wires from Lakeport to Meredith, a distance of about 6 miles, and the current for operating the Meredith light will be taken from the main power station.

**New York, N. Y.*—The Commercial Constr. Co., 1 Madison Ave., has secured the contract for the electric equipment of addition to and alterations in School No. 10 (bids opened Oct. 23) for $10,265.

Brooklyn, N. Y.—The Kings County Electric Light & Power Co., of Brooklyn, it is reported, has applied to the State Gas & Electricity Comn. at Albany for permission to increase its capital from $5,000,000 to $10,000,000 for the purpose of improving its plant.

Castleton, S. I., N. Y.—Bids will be received until Nov. 16 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing electric equipment in addition to and alterations in School 16, Boro. Richmond.

Lockport, N. Y.—It is stated that a 100-year franchise has been granted to the Economy Light, Heat, Fuel & Power Co., to use the streets for light, heat, gas, power and refrigerator purposes.

Macedon, N. Y.—It is stated that the Town Bd. has granted a franchise to the Niagara & Lockport Power Co. to erect poles and wires for the transmission of heat, power and light along the highways of the town.

Buffalo, N. Y.—Bids will be received by the Dept. Pub. Wks. (Francis G. Ward, Comr.) until Nov. 3 for the following: Cable for lighting the pumping station, Bureau Water, foot of Massachusetts Ave.; length, 15,000 ft.; cable for supplying power to the 2d electric pump at pumping station, foot of Massachusetts Ave.; length, 15,000 ft.; cable for police telegraph service; length, 15,000 ft.; cable for fire telegraph service; length, 15,000 ft.

Central Islip, N. Y.—Bids will be received by T. E. McGarr, Secy. State Comn. in Lunacy, Albany, until Nov. 1 for outside lighting system at Central Islip, State Hospital, as advertised in The Engineering Record.

Greenville, O.—The City Council is reported to have granted the Ohio & Indiana Natural & Illuminating Gas Co. a franchise to construct and maintain an artificial gas plant.

Ashtabula, O.—The Supt. Electric Light Plant is reported to have petitioned Finance Com. for an appropriation of $7,250 for improvements to the electric light plant.

Foley, Minn.—O. F. Doyle, it is reported, has submitted an estimate to the citizens of Foley, estimating the cost of a water works and an electric light plant, including poles, etc., at a total of $13,144.

Danville, Pa.—The date of opening of bids for the erection of a power house, electric generator plant, engines, boilers, motors, etc., and wiring the Adminstration Building, wards and other buildings, grounds, etc., has been extended from Oct 27 to Nov. 10, as advertised in The Engineering Record. Address all bids to Dr. Levi I. Shoemaker, Chmn. Bldg. Com. Bd. Trus. State Hospital for Insane, care of Dr. H. B. Meredith, Supt.

Lebanon, Pa.—Geo. R. Hersey and Eli Nisley are reported to have secured an electric light franchise.

Edgefield, S. C.—It is reported that it is proposed to install an electric light plant here. Address City Engr.

**Knoxville, Tenn.*—The City Council, it is reported, has authorized the Bd. Pub. Wks. to award to the Knoxville Ry. & Light Co., a contract for 303 or more arc lights at an annual cost of $72.50 per light per yr. for a period of 10 years and to the Carbon Light & Power Co., a contract for 150 or more Welsbach gas lights of 62 c.p. ea. at an annual cost of $21.50 ea.

Orange, Tex.—Saml. C. Trimble, Pres. Orange Ice, Light & Power Co. writes that no new construction work is contemplated by this company.

Milwaukee, Wis.—The Common Council is reported to have authorized the Bd. of Pub. Wks. to procure bids for lighting the streets for terms of 1, 2, 3, 4, 5 and 10 years.

Montreal, Que.—The City Council is reported to have appointed a commission of experts to report on the cost of the production of gas. The experts appointed are: W. H. Pearson, Pres. of the Consumers Gas Co., of Toronto, Ont.; Francis Giroux and Ernest Belanger, engineers, both of Montreal.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Sacramento, Cal.—Gen. T. W. Sheehan is stated to have filed a petition with the Bd. of Superv. for an electric railway franchise to run from the city to Florin; also for a franchise for an electric road which will run southerly in almost a straight line to Old Elk Grove and New Elk Grove.

Avalon, Cal.—The Banning Co. is reported to have applied to the Supervisors for a franchise for a double-track street railroad, at Avalon, Santa Catalina Island.

San Jose, Cal.—It is stated that a contract has been awarded to the Mount Hamilton Exploitation Co. to build, equip and operate an electric road to the summit of Mount Hamilton.

Napa, Cal.—It is stated that a railroad is to be built to Lake County, through Marin, Napa and Sonoma Counties, as planned by the Clear Lake & Southern R. R. Co. Surveyors are in the field at present above St. Helena, and will commence grading for the road in a short time. The company will operate a ferry system between San Francisco and the Marin County shore, and will then run a line through Sonoma and Napa Counties up through Conn, Chiles and Pope valleys to Butts Canyon and on to Lakeport. This will be an electric railroad. There will also be branch lines from Point San Quentin to San Rafael, in Marin County, and Reclamation to Petaluma.

Chicago, Ill.—It is stated that W. S. Reed, promoter of the Chicago Southern Traction Co., First National Bank Bldg., Chicago, is making extensive plans for the improvement of the Chicago Electric Traction lines in Chicago, which he recently purchased.

Herman, Ill.—It is stated that it is proposed to extend the Southern Illinois Coal Belt & Electric Ry. from Herman to Carbondale, and make this new road a connecting line to St. Louis.

Jacksonville, Ill.—The Illinois Traction Co. is reported to have announced that work will be commenced early next year on the proposed line between Springfield and Jacksonville. The contract has been made for the delivery of 135 miles of steel rails.

Logansport, Ind.—The Circuit Court is stated to have granted the petition of the Ft. Wayne & Wabash Valley Traction Co. to condemn the tow-path of the old canal in Cass and Carroll Counties for a right of way for an electric railway.

**Indianapolis, Ind.*—The Keystone Constr. Co., of Philadelphia, Pa., is stated to have secured the contract for the construction of the Indianapolis & Western Electric Ry.'s line, between Indianapolis and Brazil.

Marion, Ind. — The Marion, Hartford & Eastern Ry. Co. is stated to have filed articles of incorporation with the Secretary of State. Capital, $25,000. The object is to promote, finance, construct and equip in the State of Indiana and elsewhere street and interurban railroads. The first road to be constructed and operated through the counties of Grant, Blackford and Jay connecting Marion, Gas City, Upland, Hartford City, Milgrove, Dunkirk and Redkey. J. L. Thompson, R. A. Broshear, W. B. Dodds and F. R. Chandler, directors.

Marshalltown, Ia.—The Union Traction Co., of Iowa, is reported organized to build an electric interurban railway, from Marshalltown via Grundy Center to Waterloo. Capital $100,000. D. T. Denmead, Pres.; L. C. Norris, secy., and Geo. E. Lichty, Treas.

Dubuque, Ia. — The Dubuque, Iowa & Wisconsin Ry. Co. is reported organized with a capital of $151,501. The articles state that the business of the company shall be the construction, lease, purchase and equipment and maintenance and operation of lines of railway operated by steam or other motive power, and telegraph and telephone lines from Dubuque, Ia., into and through the States of Iowa, Illinois and Wisconsin to such point or points as the company may hereafter deem advisable. The articles provide that the company shall also have power to do all other things in the way of securing real estate, buying and selling same; erecting depots, terminals, etc., as shall be necessary to carry on the business of the company. Directors: J. M. McFadden, A. W. Tredway, F. J. Peikenbrook and others.

Lawrence, Kan.—It is stated that most of the right of way for the Kansas City, Stranger Valley & Western Ry. through Leavenworth County has been secured.

**Brimfield, Mass.*—Fred. T. Ley & Co., of Springfield, are stated to have secured the contract for constructing a trolley line from Brimfield to Fiskdale.

Northampton, Mass.—It is reported a plan is being considered for building an electric railway through the Berkshires to this city and possibly to points further east, so as to connect the eastern part of the State of New York with the western section of Massachusetts. It is estimated that the cost of constructing the road would be about $2,000,000 for rails, roadbed and equipment if the line were carried from Albany through Chester to Northamtpon. One of the projectors of the enterprise is J. F. Lape, of Renssalaer, N. Y.

Lee's Summit, Mo.—A franchise is stated to have been granted by the City Council of Lee's Summit to the Kansas City-Lee's Summit Eastern Electric R. R. The franchise grants to build a double-track standard electric line through the streets and maintain it in operation for thirty years.

Paterson, N. J.—Pres. Wm. Barbour, on behalf of the directors of New York & North Jersey Rapid Transit Co., is reported to have accepted the franchise granted by the Bd. of Aldermen to the company. The company will now proceed to purchase private rights of way from this city to the Hudson River. Part of the road will be elevated, and it is the intention of the directors of the company to run cars to New York in 20 minutes.

Nelsonville, O.—The Nelsonville, Athens & Glouster Traction Co. is reported securing right of way for a line between Athens, Nelsonville, Buchtel and Glouster. It is stated that the line may be extended to Lancaster. The promoters of the company are: L. F. Carpenter, T. E. Wells, Charles Lutt, B. C. Wise and others, of Nelsonville.

Zanesville, O.—The Ohio River & Western R. R. Co. is stated to have announced that it proposes to lay a third rail for standard-gauge track between Bellaire and Elden, and will operate gasoline cars over that part of the track. If the scheme proves successful service will be extended over the whole road.

Ravenna, O.—E. R. Merrell is reported to be securing right of way for a line from Ravenna to Alliance, which eventually will be extended to Cleveland.

**Akron, O.*—The Northern Ohio Traction & Light Co. is stated to have awarded the General Electric Co., of Schenectady, N. Y., the contract for new machinery for its power plant, to consist of a 1,500-kw. steam turbine, a 1,000-kw. motor geenrator set and a 300-kw. motor generator.

Hillsboro, O.—J. N. Gardner and R. S. Smith, of New York, are reported to be securing the right of way for a line from Hillsboro to Washington Court House and thence to Columbus.

Andover, O.—The Meadville & Cambridge Springs Traction Co., which is building between Meadville and Cambridge Springs, is reported to be planning to extend the line to Andover just over the line in Ohio. Eventually the line may be extended to Cleveland.

Canton, O.—The Canton & Youngstown Ry. Co. is stated to have announced that the line will be built next year. It will extend from Canton to Youngstown, with a branch from St. Joseph to Akron. The line will connect at Atwater with the proposed Alliance, Ravenna & Cleveland line, making a short route between Cleveland and Canton.

Oklahoma City, Okla. Ter.—The Oklahoma St. Ry. Co. is stated to have decided to build to Capitol Hill at once.

Chattanooga, Tenn.—The Tennessee-Georgia Interurban Electric Ry. Co., which has been chartered with $100,000 capital for the purpose of building an electric railroad from this city through Chickamauga Park to Spring Place, Ga., is reported to have had surveys made for the proposed line.

Waxahachie, Tex.—The Council is stated to have granted a franchise to J. S. Daugherty, of Houston, to construct, operate and maintain an interurban line over certain streets in Waxahachie. The projectors of the enterprise contemplate constructing a line between Ennis and Dallas and Waxahachie, passing through Lancaster and Red Oaks.

Seattle, Wash.—The Seattle, Everett & Skagit Ry. Co. is stated to have decided to build an electric railway from Seattle to Everett, and later to extend the road so as to complete it between Seattle and Bellingham Bay. It is stated that the contract for building the road has been awarded to L. M. Rice, of Seattle. W. H. Goldson, Pres.; Edwin S. Gill, Secy.; Otto Stendahl, Treas.

Morgantown, W. Va.—W. W. Smith, of Morgantown, Attorney for the Morgantown & Dunkard Valley R. R. Co., writes that it is proposed to construct an electric railway 42 miles in length from Morgantown to Mennington; probable cost of work. $300,000 to $500,000. Prof. C. R. Jones will have charge of the electrical part of work. Bids will be called for in 60 or 90 days.

RAILROADS.

Notes Arranged Alphabetically by States.

Chicago, Ill.—See "Business Buildings."

Cairo, Ill.—The Cairo & Thebes R. R. Co. is reported incorporated with a capital of $10,000. A. E. Smith, Pres.; J. B. Magee, Vice-Pres., and Judge W. S. Dewey, Secy., all of Cairo.

Dawson Springs, Ky.—W. G. Harris, Gen. Mgr. Dawson Springs & Madisonville R. R. Co., writes that the proposed railroad will cost about $350,000.

Wabasha, Minn.—The Chicago, Milwaukee & St. Paul Ry. Co. (D. J. Whittemore, Ch. Engr., Chicago, Ill.) is reported to have decided to construct a double track between Wabasha and Lake City. thus putting in another link of a double-track system between Chicago and St. Paul.

Beaufort, N. C.—The Beaufort & Western Ry. Co. has been organized with a capital of $250,000 to build a bridge and railroad from Beaufort to Morehead. It is probable that other extensions will also be built later. Directors: F. L. Merritt, R. P. Foster, M. Manly, W. A. Mace and C. D. Jones.

Portland, Ore.—The Pacific Railroad & Navigation Co.

**Items marked thus give the names of parties awarded contracts.*

is reported incorporated with a capital of $2,000,000, to construct a railroad to connect Portland with Tillawook and Neholm, and also a branch to Astoria, joining the road of the Southern Pacific at Hillsboro, Ore., or Forest Grove, Ore., and of the Northern Pacific at Scappoose, Ore., the latter to be a line starting at or near Pittsburg, Ore. Incorporators: Elmer E. Lytle, Chas. Wanzer and Zera Snow, all of Portland.

York, Pa.—The Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia) is reported to have decided to build a freight cut-off around York. It will start near Emigsville and take a southwesterly direction around the city of York. Wm. W. Gray, of Wormleysburg, will, it is stated, superintend the work.

Uniontown, Pa.—J. V. Thompson, of Uniontown, with others, is reported to have formed the Uniontown & Wheeling Short Line R. R. Co. to construct a railroad from Uniontown to Wheeling and Benwood, W. Va.; it will be about 68 miles in length and cost about $15,000,000.

**Seymour, Tex.*—J. P. Nelson, of San Antonio, is reported to have secured the contract from the Wichita Valley R. R. Co., to build an extension from Seymour to Stamford, a distance of about 60 miles.

Sonora, Tex.—It is reported that the main branch line of the Kansas City, Mexico & Orient R. R. Co. (M. P. Paret, Ch. Engr., Kansas City, Mo.) which is to be built from San Angelo into Mexico, will come through Sonora.

Houston, Tex.—The Houston, Sabine & Red River R. R. Co. has been organized to build a railroad from Houston northeast via Jasper and Sabine, Tex., Burr Ferry, La., and Alexandria, La., to Natchez, Miss.; capital, $500,000. Chief offices at Houston, Tex. H. W. Cortes, Pres.; Ed. Kennedy, Vice-Pres. and Gen. Mgr.; J. M. Cotton, Secy., Houston, Tex. Surveys have been completed from Houston to Jasper, and contracts will be let shortly.

Seattle, Wash.—The Pacific R. R. Co. is reported incorporated with a capital of $3,000,000 to construct a railroad from Seattle to Wallula. W. R. Williams, Pres.; A. N. Barkley, Secy.-Treas.; W. L. Darling, Ch. Engr.

Casper, Wyo.—The Chicago & Northwestern R. R. Co. (E. C. Carter, Ch. Engr., Chicago, Ill.) is reported to have adopted plans for the extension of its line in five States. The longest line to be constructed will be across Wyoming. It will be known as the Wyoming & Northwestern R. R. (J. P. Cantillon, Div. Supt., Casper), and extend westward from Casper, Wyo. Next in importance to the Wyoming line under construction is the line to be built across the western part of South Dakota from Pierre to Rapid City.

Salt Lake City, Utah.—The Chicago, Burlington & Quincy R. R. Co. (T. E. Calvert, Ch. Engr., Chicago, Ill.) is reported to have decided to at once begin the construction of 800 miles of road to extend its lines to Salt Lake. The line will start from a point near Broken Bow, Neb., and run to Bridgeport, Neb., where it will connect with the Guernsey, Wyo., line. Amended articles of the Burlington road are reported to have been filed at Omaha, Neb., with the County Clerk by Gen. Mgr. G. W. Holdredge, of Omaha, Neb., to cover the new extension which will be part of the Nebraska, Wyoming & Western R. R. The branch from Bridgeport eastward to the main line will be about 250 miles in length, and the line from Guernsey to Salt Lake 550 miles long.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—The Co. Levying Bd., it is stated, has made an appropriation of $15,000 for the erection of a county hospital, and has authorized additions to and alterations in the county court house at Pine Bluff at a cost of $40,000. Gibb & Sanders, of Little Rock, are said to be the archts. for the improvements.

Van Buren, Ark.—It is stated that the Co. Comrs. will soon ask bids for making additions to the court house at a cost of $12,000, for which plans are now being prepared by Gibb & Sanders, of Little Rock.

Monrovia, Cal.—The citizens, it is reported, have voted in favor of issuing $25,000 bonds to erect a city hall and park and $10,000 for a library.

Los Angeles, Cal.—It is stated that a site has been donated to the city for the proposed city hall. It is said to be the intention of the city to erect a city hall at a cost of about $1,000,000.

**Hartford, Conn.*—The Bd. of Contract & Supply, it is stated, has awarded the contract for the 54 steel cells at the police station to the Van Dorn Iron Wks., of Cleveland, O., at $23,667. Other bids received were from the Berlin Iron Bridge Co., at $23,900, and the Pauly Jail Bldg. Co., at $26,500.

Ft. Du Pont, Del.—Bids will be received by Capt. Louis F. Garrard, Jr., Q. M., U. S. A., Delaware City, until Nov. 28, for constructing additon to and alterations of present pump house at Ft. Du Pont, as advertised in The Engineering Record.

Washington, D. C.—In the annual estimates of the Bd. of Charities for the year 1906, beginning July 1, the Bd. recommends that new buildings be constructed at the Columbia Hospital, and an appropriation of $100,000 for this purpose, and that the new municipal hospital be started, and that $150,000 be appropriated for preliminaries, etc., for this building.

**Marianna, Fla.*—It is reported that M. D. Lumen & Co., of Louisville, Ky., have secured the contract to erect the court house at $46,625.

Tampa, Fla.—Bids will be received until Nov. 27 by Jas. Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C., for improvements at Tampa Bay Quarantine Station, Mullet Key.

Pensacola, Fla.—Bids will be received until Nov. 27 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for constructing a hospital, wharf, etc., at Santa Rosa Quarantine Station, Pensacola.

Bronson, Fla.—The citizens are reported to be in favor of issuing $15,000 bonds, for the purpose of erecting a court house.

Lumpkin, Ga.—It is reported that bids will be received until Nov. 15 by the Bd. Co. Comrs. (A. H. Simpson, Chmn.) for erecting a fireproof brick jail. Wagner & Dobson, Archts., Montgomery, Ala.

Brunswick, Ga.—A. O. Townsend, Clk. Comrs. Roads and Revenue, writes that the proposed court house will cost from $65,000 to $80,000. Architect, C. A. Gifford, New York, N. Y.

Boise, Idaho.—It is stated that Wm. Hamilton, of Des Moines, Ia., submitted the lowest bid for erecting a hospital at Boise Barracks, at $20,360.

Evanston, Ill.—George L. Harvey has prepared plans for a maternity hospital to be built in connection with the Evanston Hospital. The plans provide for a 3-story fireproof structure, to cost in the neighborhood of $50,000. The estate of the late Mrs. Elizabeth Williams has donated $25,000 toward the cost of the building, which will be known as the Elizabeth Williams Memorial Hospital.

Chicago, Ill.—The City Council has appropriated $150,000 for the new police station to be erected at 539-551 State St., to take the place of the present Armory on La Salle and Harrison Sts. Plans are being prepared by Richard E. Schmidt, 172 Washington St., with Holabird & Roche, 1618 Monadnock Bldg., as associate architects, for a structure to be 10 stories high, 120 x 139 ft., and of fireproof construction.

Dr. George W. Green has had plans prepared for a hospital to be built at 489-499 Wilson Ave. The building permit provides for a 4-story structure, 46 x 75 ft., to cost $30,000.

Indianapolis, Ind.—The Bd. Pub. Wks., it is reported, has purchased a site and will soon ask bids for erecting a fire house to cost $75,000.

**Gretna, La.*—The following are reported to be the bids received Oct. 16 for erecting the court house at Gretna: F. B. Hull Constr. Co., Jackson, Miss., $74,750 (awarded contract); W. M. Wren Co., New Orleans, $77,200, and Congress Constr. Co., New Orleans, $81,693.

Baltimore, Md.—The Bd. Pub. Improvements on Oct. 14, it is stated, approved the following ordinances: Appropriating $47,500 for the purchase of a lot and the equipment of an Engine Co., to be known as No. 29, at Kate Ave. and the Reisterstown Road; appropriating $54,000 for the purchase of a lot and the equipment of No. 30 Engine Co., at Eastern Ave. and Caroline St., and appropriating $44,040 for the purchase of a lot and the equipment of No. 13 Truck Co., at Pratt and Calhoun Sts.

Lawrence, Mass.—The Bd. of Aldermen has adopted an order for a fire engine house in Ward 6. C. F. Lynch, Mayor.

Caro, Mich.—The Co. Bd. of Superv., it is reported, is planning to hold an election to vote on the question of issuing $100,000 bonds for the erection of a court house.

Port Huron, Mich.—The Co. Bd. of Superv., it is stated, is considering the erection of a $150,000 county building.

Ft. Wayne, Detroit, Mich.—The following are reported to be the bids received Oct. 3 for erecting 2 double sets of barracks, also a double set of lieutenants' quarters and a double set of captains' quarters at Ft. Wayne. The bids submitted are totals on the 4 buildings: W. Hamilton, Chicago, Ill., $122,237; B. F. Atkinson, Colorado Springs, Colo., $125,680; B. M. Zaddock, Chicago, Ill., $127,902; R. P. & E. O. Hamilton, Omaha, Neb., $136,666; Mosier & Summers, Buffalo, N. Y., $136,764; W. J. Ternes Co., Chicago, Ill., $137,078; D. Hayes, Chicago, Ill., offered to build the two barracks for $88,840. Bids were also received for the plumbing, gas fitting and heating of said buildings.

Dekalb, Miss.—It is reported that bids will be received until Nov. 6 by the Co. Bd. Superv. (Sam. O. Bell, Clk.) for remodeling and repairing jail.

Walker, Minn.—It is stated that next spring a State sanatorium is to be erected on Cass Lake, near Walker, by the State Bd. of Control, at a cost of $50,000.

Kansas City, Mo.—It is stated that bids will be received until Nov. 28 by Jas. L. Phelps, Clk. County Court, at Independence, Mo., for constructing cells in jail at Kansas City.

Kansas City, Mo.—The erection of a new armory for the 3d Regt., to cost about $250,000, is reported under consideration. The Commercial Club may be able to give further information.

**Jefferson Barracks, Mo.*—Carl Bushnell, of Chicago, Ill., has secured the contract for erecting the new bakery wagon shed, addition to coal shed and addition to guard house at the post here for $33,297.

St. Louis, Mo.—Dr. Wm. R. Faulkner, Custodian of the Police Properties, it is stated, will prepare plans for the police headquarters building which it is proposed erecting on Clark St.

**Richmond, S. I., N. Y.*—Herbert S. Brower, Great Kills, S. I., has secured the contract for plumbing, heating, tiling, masonry, carpenter and electric work required for the court house at Richmond (bids opened Oct. 24).

**Saratoga Springs, N. Y.*—Meehan & Co., it is stated, have secured the contract for the plumbing in the armory for Co. L at Saratoga Springs at $1,400, and H. J. Freeman the contract for additions to the heating plant at $2,000. Both contractors of Saratoga. The contract for the electric wiring and lighting of the armory, it is stated, has been secured by John Kelly, of Schenectady, at $3,300.

**Rochester, N. Y.*—Barr & Creelman, 24 Exchange St., it is stated, have secured the contract to install the plumbing, heating and gas fitting in the new fire headquarters building on Central Ave. at $9,635.

H. G. Danforth, Pres. Bd. Trus. of the City Hospital, it is stated, has announced that Mrs. Robt. Bartlett and Mrs. G. D. B. Bonbright intend erecting a 3-story addition to the hospital as a memorial to their father, the cost to be about $50,000.

Tompkinsville, S. I., N. Y.—Bids will be received until Nov. 15 by Lieut. Col. Wm. T. Rossell, Corps Engrs., U. S. A., Tompkinsvile, for furnishing material and remodeling the old oilhouse into a blacksmith shop, Light House Depot, Tompkinsville.

**Fargo, N. D.*—Schlanser & Ostbye, it is reported, have secured the contract to erect the city hall at $17,251.

Philadelphia, Pa.—Bids will be received until Nov. 18 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for a heating system for building No. 18, Navy Yard, League Island; estimated cost $16,000.

**Harrisburg, Pa.*—Coder & Miller, of Harrisburg, it is stated, have secured the contract to erect the 2 temporary corrugated iron wards at the Harrisburg State Hospital for the Insane, at $29,000 (bids received Oct. 18).

It is stated that bids received at the same time for a 2-story brick house for women nurses and a building for violent women patients at said hospital were all too high.

Deadwood, S. D.—All bids are reported to have been rejected by the Superv. Archt., Treas. Dept., Washington, D. C., for heating the U. S. Post Office at Deadwood.

It is stated that bids will be received until Nov. 3 by Wm. McLaughlin, Co. Aud., for erecting a 2-story and basement brick and stone court house. Bell & Detweiler, Archts., Minneapolis, Minn.

Memphis, Tenn.—A site has been selected, bounded by 2d, 3d, Washington and Adams Sts., on which it is proposed erecting the new court house.

J. A. Omberg, Jr., City Engr., it is stated, has completed specifications for the 2-story brick veneered emergency hospital, which is to be erected on the lot adjoining the City Hospital. The cost to be about $12,000.

Houston, Tex.—The plans of Chas. H. Page, Jr., of Austin, for the Houston Charity Hospital, it is stated, have been accepted. It is reported that the plans provide for a main structure and 2 wings, the total cost to be about $150,000. It is stated to be the intention of the Bd. of Mgrs. to erect the main structure first, at a cost of $50,000, the wings to be added when needed.

Seattle, Wash.—Dr. Geo. W. Hawley, it is reported, is at the head of a movement to erect a $75,000 hospital here.

Vancouver Barracks, Wash.—The following are the totals of bids opened on Oct. 18 by the Constructing Q. M., U. S. A., for the construction complete of 5 buildings at this post: (*a*) with stone foundation, (*b*) with brick foundation. Lister Constr. Co., Tacoma, *a* $176,450, *b* $175,750. Langford & Walker, Portland, Ore., *a* $242,455. Bringham & Hoska, Seattle, *a* and *b*, $185,419. J. E. Bennett, Portland, Ore., *a* $162,880, *b* $161,480. Hastie & Dougan, Seattle, *a* $168,997. McInnis & Reed, Portland, Ore., *a* $172,966, *b* $172,456. John Scott, of Tacoma, bid for constructing one building on stone foundation $43,969. Bids were also submitted for portions of the work.

**Waterville, Wash.*—Wm. Oliver, of Spokane, it is stated, has secured the contract to erect the brick and granite court house here to replace the structure destroyed by fire, at $32,000.

Toronto, Ont.—Sullivan & Langdon, of Kingston, it is stated, submitted the lowest bid for erecting the barracks at Toronto, at about $225,000.

**Ottawa, Ont.*—It is reported that the Dept. of Pub. Wks., at Ottawa, has awarded the contract for erecting the new immigration buildings as follows: At Halifax, N. S., to Samuel Marshall, for $51,997; at Winnipeg, Man., to Cotter Bros., for about $53,000; at Quebec, Que., to Juchereau & Lamont, for $55,850.

Wausau, Wis.—It is stated that plans will be recived until Nov. 1 by the Bd. Pub. Wks. for a city hall. Geo. A. Steltz, Chmn. Com.

St. Johns, Que.—Bids will be received until Nov. 10 by Fred. Gelinas, Secy., Dept. Pub. Wks., Ottawa, Ont., for constructing a Post Office at St. Johns. J. A. E. Benoit, Archt.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—It is stated that the Mobile & Ohio R. R. Co. (F. T. Lack, Res. Engr., Mobile) intends erecting a 2-story fireproof warehouse on Government, Conti and Dauphin Sts.

Florala, Ala.—Bids are wanted until Nov. 15 for erecting a $10,00 opera house and a $20,000 hotel; plans and specifications on file at Lockwood Bros., Archts., Columbus, Ga.; Lake Jackson Hotel Co., Florala, is interested.

San Francisco, Cal.—It is reported that the Grand Central Hotel is to be remodeled at a cost of $90,000. Fulton G. Berry, of Fresno, may be able to give further information.

Silverton, Colo.—Otto Mears, it is stated, is planning to erect a hotel here to cost about $100,000.

Athens, Ga.—It is reported that it is proposed to erect a $100,000 hotel here.

Atlanta, Ga.—Dr. Horace Grant, it is stated, is interested in the project to erect a 14-story building, to contain a theatre, hotel and roof garden.

Decatur, Ill.—The Illinois Grand Lodge K. of P., it is stated, has appointed a committee of seven, of which Chas. L. Fry, of Chicago, is a member, to select a site and erect a building costing not more than $35,000 for the aged Pythians and orphans of the State.

Chicago, Ill.—Plans for the construction of a new union railway station at a cost of from $5,000,000 to $10,000,000, and enlargement of passenger terminals to cost $15,000,000, it is stated, are being considered by the 5 tenants of the present Union station, who are the Pennsylvania, the Panhandle, the Chicago & Alton, the Chicago, Milwaukee & St. Paul and the Chicago, Burlington & Quincy, all of which have agreed to share equally the cost of the improvements. W. H. Brown, Ch. Engr. Penn. R. R., Philadelphia, Pa.

Mrs. Mary A. Ryerson will erect at 551-553 Wabash Ave. a mercantile building for which Holabird & Roche, 1618 Monadnock Bldg., have prepared plans. The structure will be 6 stories high, of pressed brick, and is estimated to cost $80,000.

Watson & Hazelton, 305 Dearborn St., are preparing plans for a $45,000 factory and warehouse which is to be built at 178-180 W. Jackson Boule., for the American Posting Service Co.

W. Carbys Zimmerman, 21 Van Buren St., is preparing plans for a storage and warehouse to be built for G. A. Foster, at 1426-32 W. Madison St. The building will be 6 stories high, 60 x 100 ft., and cost $80,000.

Andrew Sandegren, 119 Monroe St., has prepared plans for a store and office building, to be built at 400-404 63d St., for Benj. Newman. The building will be 2 stories high, 60 x 130 ft., and cost $30,000.

Aurora, Ill.—The Richards Mfg. Co. will erect 2 brick

**Items marked thus give the names of parties awarded contracts.*

buildings, one 138 x 64 ft., and another 24 x 40 ft.; also a warehouse for steel and iron, 30 x 80 ft. No power plant required.

***Muncie, Ind.*—R. H. Clark, Secy. Delaware Lodge, F. A. M., No. 46, writes that J. B. Ludlow has secured the contract for erecting the building for this lodge for about $40,000.

Indianapolis, Ind.—The Taggart Bakery Co., it is reported, intends erecting a 3-story fireproof stable on Court and New Jersey Sts., to cost about $30,000.

Mason City, Ia.—The Iowa Grand Lodge of Odd Fellows, it is reported, has appropriated $45,000 toward the erection of an orphans' home at Mason City.

Council Bluffs, Ia.—Walter H. Goodrich, prop. of the Metropolitan Hotel, it is stated, intends erecting a $40,000 3-story, 66 x 120 ft. hotel on Bway. and 8th St.

Louisville, Ky.—Jos. L. Rhinock, of Covington, it is stated, is interested in the project to erect a $250,000 theatre in this city.

Kansas City, Kan.—W. W. Rose, of Kansas City, Mo., it is reported, has about completed plans for a 3-story brick and stone hotel which is to be erected on Ann Ave. and 6th St., by Henry McGrew, at a cost of $75,000.

**New Orleans, La.*—Milliken Bros., of New York, N. Y., it is reported, have secured the contract to erect the Denechaud Hotel, at about $500,000.

Baltimore, Md.—Wm. J. Donnelly, of the fire insurance firm of Maury & Donnelly, it is stated, intends erecting a 2-story office building on Holliday and Water Sts.

**Worcester, Mass.*—J. W. Bishop Co., of Worcester, has secured the contract for erecting a 5-story building, 50 x 155 ft., for the Crompton & Knowles Loom Works. Architects, F. P. Shelton & Co., of Providence, R. I.

**St. Paul, Minn.*—Olaf Swanson is stated to have secured the contract for erecting a 2-story brick and stone building on Hamline Ave. and Albany St.

Minneapolis, Minn.—F. B. & L. L. Long, 830 Hennepin Ave., it is stated, have prepared plans for a 4-story building which is to be erected by the Palace Clothing Co. on the site of the Warner Bldg., at 4th St. and Nicollet Ave., at a cost of $100,000.

Kees & Colburn, 603 Kasota Blk., it is stated, are preparing plans for alterations to be made to the Wm. Donaldson & Co.'s Glass Block, at a cost of $20,000.

**Kansas City, Mo.*—Flanagan Bros., it is reported, have received the contract to erect a 4-story office building for Alex. Frazier and Saml. Lee.

St. Louis, Mo.—Theo. C. Link, Carleton Blk., it is stated, is preparing plans for the Y. M. C. A. building, which is to be erected on Eugenia and Tom Sts., for the railroad employees, at a cost of $150,000.

Omaha, Neb.—The Gund Brewing Co., of La Crosse, Wis., will soon begin the erection of a cold storage house, stables, office, etc., at this place, at a cost of $30,000. J. E. Dietrich, Ramge Bldg., Omaha, is Local Supt.

Toledo, O.—The Ohio Bldg. Co., composed of David, Will F. and Jas. J. Robison, it is stated, intends erecting a 10-story office building at Manhattan Ave. and Superior St., to cost about $500,000. Geo. S. Mills, Gardner Bldg., it is stated, is preparing the plans.

Cincinnati, O.—John J. Ryan, it is stated intends erecting a theatre on 7th St., near Walnut St., to cost about $175,000. It is to be known as the Olympic.

It is reported that a 10-story hotel is to be erected in this city by Col. Andrews, of Newport, Ky., to cost $150,000.

**Enid, Okla. Ter.*—Z. H. Sexton, it is reported, has secured the contract to erect the Field-McKenzie Lee Bldgs., at $24,000.

Portland, Ore.—The University Club, it is stated, has purchased a residence and intend making improvements for club purposes at a cost of $15,000.

**Philadelphia, Pa.*—J. E. & A. L. Pennock, 307 Walnut St., it is stated, have secured the contract to erect an addition to the building of the Pennsylvania Historical Society at 13th and Locust Sts. The building is to be 4 stories high, of brick and stone, and cost about $150,000.

Chattanooga, Tenn.—The Bijou Theater Co. is reported organized by J. B. Pound, Harry E. Stoops, P. A. Brawner, and others, to erect a theater, to cost about $40,000.

Sam B. Read, proprietor of the Read House, of this city, will rebuild the hotel at a cost of about $150,000. The new building will be 8 or 10 stories and fireproof.

Ft. Worth, Tex.—It is reported that Sanguinet & Staats, Hoxier Bldg., have prepared plans for an Elks Home, which it is proposed erecting here at a cost of $40,000. Wm. Bryce, Chmn. Bldg. Com.

Dallas, Tex.—Theo. Beilharz, of Dallas, it is reported, has secured the contract to erect an annex to the Oriental Hotel at a cost of $250,000.

Bristol, Va.—Barber & Kluttz, of Knoxville, Tenn., it is stated, have been engaged to prepare plans for a brick and stone hotel which is to be erected at Bristol at a cost of $50,000.

It is stated that Barber & Kduttz, of Knoxville, Tenn., have been engaged to prepare plans for a Y. M. C. A. bldg., which it is proposed erecting here at a cost of $40,000.

Sprague, Wash.—E. Redding, it is stated, will erect a $20,000 cement block hotel here.

Tacoma, Wash.—P. H. Hebb, it is stated, intends erecting a 7-story brick and stone, 85 x 200 ft. apartment hotel on St. Helens Ave., to cost about $100,000.

Everett, Wash.—It is stated that the Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.), intends erecting a brick and stone depot here.

Kenosha, Wis.—Horace Royce, prop. of Hotel Kenosha, it is reported, has announced that it is proposed to erect a hotel to cost about $80,000.

Milwaukee, Wis.—C. D. Crane, 91 Wisconsin St., it is reported, is preparing plans for an addition to be erected to the Hotel Fizette, at a cost of $30,000.

Abraham Gold, it is reported, intends erecting a $30,000 store building at 549 E. Water St.

Chihuahua, Mex.—It is reported that The Banco Nacional de Mexico will erect a building on Libertad and Independencit Sts., to cost $70,000, and that Gen. Terrazas intends erecting a building at Victoria and Independencia Sts., to cost $90,000.

New York, N. Y.

555 W. 22d St., 4-story br. and stone loft bldg.; c, $25,000; o, Frank O'Rourke; a, Henry Davidson.

207 W. 24th St., 11-story br. and stone loft bldg.; c, $250,000; o, Franmor Realty Co.; a, Schickel & Ditmars.

228 W. 63d St., 4 6-story br. and stone stores and tenemts.; total c, $128,000; o, Jacob Boltan; a, Louis C. Maurer.

78th St. and Ave. A, 6-story br. and stone store and tenemt.; c, $30,000; o, Reisler & Freudenheim Realty & Constr. Co.; a, Moore & Landsiedel.

231 E. 103d St., 2 6-story br. and stone stores and tenemts.; total c, $60,000; o, Schlesinger, Horn & Fuchs; a, Horenburger & Straub.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—Miss H. E. Hackett, it is reported, will erect a residence at St. Charles Ave. and 15th St., to cost $25,000.

Denver, Colo.—Marean & Norton, Dodge Bldg., it is stated, have prepared plans for a stone and terra cotta residence which is to be erected for B. H. Fowler on Lafayette St., at a cost of $20,000.

Atlanta, Ga.—It is stated that the congregation of St. Luke's Episcopal Church has authorized the archt. to prepare plans for a new edifice and bids to be asked at once for the erection of same, the cost not to exceed $50,000.

Chicago, Ill.—W. A. Nicholson, 6541 Greenwood Ave., has completed plans for an apartment building for B. F. George, to be erected at Prairie Ave. and 54th St., to cost $100,000.

Bishop & Co. are preparing plans for a 3-story apartment building, 114 x 70 ft., to be built for A. O'Donnell at 51st St. and Indiana Ave., at a cost of $50,000.

Geo. Kingsley, 36 La Salle St., is preparing plans for an apartment building which is to be built for Julius Frank at 173-175 Lake View Ave. It will be 3 stories high, 32 x 141 ft., and cost $50,000.

W. Z. Partello, the builder, will erect 2 flats on Kenmore Ave., near Foster Ave., according to plans by Paul Hansen, 219 Winthrop Ave. They will be 3 story structures, 34 x 78 ft. each, and will cost together $45,000.

Pruitt & Moore have had plans prepared by William G. Krieg, 84 Washington St., for a 3-story apartment, 100 x 125 ft., to be built at Champlain Ave. and 50th St., at a cost of $60,000.

C. F. Rush will build a 3-story apartment house, 100 x 100 ft., at Washington Ave. and 57th St., at a cost of $60,000.

A building permit has been granted for the Congress Apartment Bldg., which is to be erected at 228 Michigan Ave., at a cost of $750,000.

Dubuque, Ia.—Plans are being prepared by Thos. T. Carkeek, of Dubuque, for remodeling the First Presbyterian Church for the use of the Masonic bodies of Dubuque.

Hyde Park, Mass.—Funds are being raised for the building of a new parish house for the Roman Catholic Church, to cost about $10,000.

**Battle Creek, Mich.*—A. G. Wilbur, of Battle Creek, it is reported, has secured the contract to erect a residence for S. O. Buch, at $20,000.

Minneapolis, Minn.—Wm. Channing Whitney, Loan & Trust Bldg., it is stated, has prepared plans for a brick and stone residence to be erected at 225 Clifton Ave., for C. D. Velie, at a cost of $30,000.

St. Louis, Mo.—Saml. G. Kennedy, it is stated, has purchased a site on Maryland Pl. and intends erecting a residence at a cost of $15,000.

South Auburn, Neb.—The Eisentraut-Colby-Pottenger Co., of Sioux City, Ia., it is reported, has been engaged to prepare plans for a brick and stone R. C. Church, to be erected at South Auburn, at a cost of $20,000.

Newark, N. J.—The congregation of Christ Reformed Church, it is stated, has voted in favor of modifying the plans for the proposed new edifice so as to bring the cost within $30,000, and to proceed at once with the erection of same.

Syracuse, N. Y.—Geo. Keister, 11 W. 29th St., N. Y. City, it is stated, has been engaged to prepare plans for an apartment house to be erected on James and N. State Sts., by the Knickerbocker Bldg. Co., of N. Y. City, at a cost of about $300,000.

Durham, N. C.—It is reported that an Episcopal Church is to be erected here at a cost of $15,000. Rev. S. S. Best, Rector.

McKees Rocks, Pa.—The congregation of the Presbyterian Church, it is reported, have decided to erect a new edifice at a cost of $20,000. Rev. O. N. Verner, pastor.

Beaumont, Tex.—Harvey L. Page, of San Antonio, it is stated, has been engaged to prepare plans for an edifice for the First Methodist Church, to cost about $39,000.

Palestine, Tex.—The Trus. of the Centenard Methodist Church, it is reported, have purchased a site and intend erecting an edifice to cost $20,000.

El Paso, Tex.—The Trus. of the Trinity M. E. Church, it is stated, have purchased a site at Mesa St. and the Boule. and intend erecting an edifice to cost $35,000. Rev. G. M. Gibson, Pastor.

Bristol, Va.—Barber & Kluttz, of Knoxville, Tenn., it is reported, have been engaged to prepare plans for a residence to cost $16,000, and also to prepare plans for a brick and stone Episcopal Church.

Wheeling, W. Va.—E. B. Franzheim, 45 14th St., it is reported, is preparing plans for an edifice for St. Andrew's Episcopal Church, the cost to be about $30,000. Rev. T. J. Oliver Curran, Pastor.

Milwaukee, Wis.—Leiser & Holst, Germania Bldg., it is stated, have filed plans for a 4-story brick flat, to be erected on Oakland Ave. and Royal Pl., at a cost of $20,000.

New York, N. Y.

153 E. 55th St., 6-story br. and stone tenemt.; c, $40,000; o, Ruff & Hoehster; a, Kurtzer & Rentz.

Ave. B and 18th St., 5 6-story br. and stone tenemts.; total c, $185,000; o, Wm. Oppenheim; a, Bernstein & Bernstein.

315 W. 69th St., 3 6-story br. and stone tenemts.; total c, $135,000; o, Andrea Avitabile; a, Nathan Langer.

204 W. 84th St., 2-story br. and stone stable and dwell.; c, $22,500; o, Philip Berolzheimer; a, L. R. Holske.

104th St. and Lexington Ave. 3 6-story br. and stone tenemts.; total c, $120,000; o, Kayfetz & Flour; a, Bernstein & Bernstein.

117th St. and Park Ave., 4-story concrete and stone rectory; c, $20,000; o, Congregation St. Paul's R. C. Church; a, Meville & Bagge.

64 E. 128th St., 6-story br. and stone tenemt.; c, $55,000; o, Jos. Bornstein; a, Bernstein & Bernstein.

Bway. and 137th St., 6-story br. and stone tenemt.; c, $150,000; o, Transit Realty Co.; a, Moore & Landsiedel.

Bway. and 141st St., 3 6-story br. and stone apartment houses; total c, $430,000; o, Interborough Bldg. Co.; a, Schwartz & Gross.

Convent Ave. and 130th St., 2 5-story br. and stone tenemts.; total c, $100,000; o, Kantor Cooper & Co.; a, Schwartz & Gross.

Wadsworth Ave. and 179th St., 3 5-story br. and stone tenemts.; total c, $125,000; o, John D. Walton; a, Neville & Bagge.

Teasdale Pl. and Cauldwell Ave., 5-story br. tenemt.; c, $50,000; o, Richard Dudensing, Jr.; a, Lorenz, F. J. Weiher.

175th St. and Washington Ave., 2 5-story br. tenemts.; total c, $40,000; o, Evans & Buscall; a, Wm. Evans.

Brook Ave. and 141st St., 2 6-story br. tenemts.; total c, $100,000; o, Wolkenberg & Gerbin; a, Geo. F. Pelham.

SCHOOLS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—The School Bd., it is stated, has accepted the modified plans for the Washington Grammar School, and it is reported that bids for the erection will soon be asked. Cost not to exceed $119,000.

It is reported that the School Bd. also approved plans for the Laguna Honda School which is to be erected on 6th Ave. and I St., at a cost of $81,000, and for the Sunnyside School to be erected on Hearst Ave. and Forester St., at a cost of $54,000. It is stated that plans are soon to be prepared for the McKinley School, which is to be erected on Castro and 14th Sts., at a cost of $81,000.

Glastonbury, Conn.—Bids will be received until Nov. 1 by the Bldg. Com., 2d School Dist. (Hector Chapman, Chmn.) for erecting a brick school.

Washington, D. C.—The Bd. of Educ., it is reported, has asked for an appropriation of $27,000 to erect a 4-room addition to Petworth School, $34,800 for the building of an 8-room building in the first division and $34,800 for a building in Anacosta.

Augusta, Ga.—Supt. Lawton B. Evans, in his quarterly report recommends the erection of a grammar school in the West End.

Duquoin, Ill.—It is reported that the Township Bd. is preparing to erect a high school to cost $32,000.

Franklin, Ind.—The Baptists of the State, it is stated, are considering the raising of $50,000 for the erection of a science hall, $40,000 for a girls' dormitory, and $30,000 for a gymnasium at Franklin College.

Bloomington, Ind.—Wm. L. Bryan, Pres. Bd. Trus., Indiana Univ., writes that bids will be received about Dec. 1 for the erection of a library for the Indiana Univ., to cost about $100,000. Architects, Patton & Miller, 140 Dearborn St., Chicago, Ill.

Pauls Valley, Ind. Ter.—It is stated that school bonds amounting to $25,000 have been sold.

Danbury, Ia.—It is stated that bids will be received until Nov. 20 by M. D. Cord, Danbury, also by Eisentraut-Colby-Pottenger Co., Archts., Sioux City, Ia., for erecting a school at Danbury.

Ames, Ia.—Proudfoot & Bird, of Des Moines, it is stated, have completed plans for the agricultural hall which is to be erected next season at Ames. It is stated that it is to be 4 stories high, of Bedford stone, 238 x 174 ft., and is estimated to cost $300,000.

Manhattan, Kan.—It is reported that bids will be received until Nov. 7 by the Regents of the State Agricultural College (E. R. Nichols, Pres.) for furnishing material and erecting a horticultural building at the State College. John F. Stanton, State Archt., 112 E. 5th St., Topeka.

Baltimore, Md.—Bids will be received until Nov. 1 by the Bd. of Awards (E. Clay Timanus, Pres.) for erecting School No. 10.

Boston, Mass.—Bids will be received until Nov. 8 by the School House Comrs. (R. Clipston Sturgis, Chmn.) for furnishing material and erecting (including ventilating and heating, electrical and plumbing work) Charlestown High School, Monument Sq., Charlestown.

Northampton, Mass.—The Bd. of Trus. of Smith College, it is stated, has appointed a Bldg. Com. to proceed with the arrangements for the construction next season of an assembly hall to cost about $100,000 and an additional residence building.

Williamstown, Mass.—Allan & Collins, of Boston, it is stated, have prepared plans for Berkshire Hall, a 3-story, 44 x 115-ft. dormitory, to cost 60,000, and for an addition to South College, to cost $25,000, both buildings to be erected at Williams College.

*L. D. Willcutt & Son, 166 Devonshire St, Boston, have secured the contract for constructing a dormitory for Williams College, at Williamstown, for about $125,000. Architects, Allen & Collins, 6 Beacon St., Boston.

Duluth, Minn.—It is stated that the American Htg. Co., of Duluth, has secured the contract to install the heating system in the ladies' dormitory at Duluth Normal School at $2,250, and the contract for plumbing to D. R. Black Co., Duluth, $2,120.

St. Paul, Minn.—In the 1906 budget adopted by the School Bd. on Oct. 18, $75,000 has been asked for the erection of a high school.

Pipestone, Minn.—Bids will be received until Nov. 21 by F. E. Leupp, Comr. Indian Affairs, Washington, D. C.,

**Items marked thus give the names of parties awarded contracts.*

for furnishing material and constructing a superintendent's residence and employes' quarters, both of stone, with plumbing, steam heat and gasoline gas piping. For further information, address Willard S. Campbell, Supt., Pipestone.

**Minneapolis, Minn.*—Trainor Bros., Boston Blk., it is stated, have secured the contract for the foundation for the new administration building which is to be erected at the State Agricultural College at a total cost of $225,000. C. H. Johnston, Archt., Manhattan Bldg., St. Paul, Minn.

Boehme & Cordella, Kasora Bldg., it is stated, have prepared plans for a parochial school which is to be erected for the Holy Cross Polish Catholic Church, the cost to be about $35,000. It is to be of brick, 2 stories high, 66 x 130 ft.

Sun River, Mont.—Bids will be received until Nov. 11 by F. C. Campbell, Supt. Ft. Shaw School, at Sun River, for furnishing about 51,000 ft. lumber, 130,000 shingles, 3,500 brick, etc.

**Jersey City, N. J.*—The Bd. of Educ., it is stated, has awarded the contract for the carpenter work on School No. 29 at Graham St. and the Boule., to Barron Donaldson, at $28,875.

North Plainfield, N. J.—The Sisters of Mercy of the R. C. Diocese of Trenton, it is stated, intend erecting a building here for a convent school, the cost to be about $300,000. David T. Kenney, of North Plainfield, has given 40 acres to the sisters as a site for this building.

New York, N. Y.—Bids will be received until Nov. 6 by C. B. J. Snyder, Supt. School Bldgs., for the sanitary work and gas-fitting of additions to and alterations in School 10; also same date for the general construction, etc., of additions to and alterations in School 25, both in Boro. Manhattan.

**Brooklyn, N. Y.*—The following are the bids opened on Oct. 23 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing ventilating and heating apparatus for School 149, Boro. of Brooklyn: E. Rutzler Co., $41,729; Rossman & Bracken Co., 132 E. 42d St., N. Y. City, $40,500 (awarded contract); Geo. A. Suter, $42,946; Dowdeswell Bros., $41,258; Walker & Chambers, $40,600.

Bids will be received until Nov. 6 by C. B. J. Snyder, Supt. School Bldgs., New York City, for the general construction of new school 42, Boro. Brooklyn; also same date for the sanitary work and gas-fitting of new School 87, Middle Village, Boro. Queens.

Long Island City, L. I., N. Y.—The following are the bids opened on Oct. 23 by C. B. J. Snyder, Supt. School Bldgs., N Y City, for installing ventilating and heating apparatus for School 87, Boro of Queens: Wm. Horne Co., $14,900; Frank Dobson, 218 E. 42d St., N. Y. City, $10,786 (awarded contract); United Htg. Co., $12,621; Rossman & Bracken Co., $12,211, and E. Rutzler Co., $11,206.

Ft. Totten, Willetts Point, L. I., N. Y.—It is reported that the War Dept. will soon ask bids for erecting a school at Ft. Totten for instruction in submarine defence work, the cost of the building to be about $100,000.

Bids will be received until Oct. 31 by Geo. H.. McManus, Constr. Q. M., U. S. A., for repair of electrician sergeants' school building at this post.

Buffalo, N. Y.—Bids will be received until Nov. 2 by the Bd. Pub. Wks. (Francis G. Ward, Comr.) for furnishing material and erecting a 16-room brick school in Dist. No. 29, at S. Park Ave. and Okell Sts. Bids to be submitted separately on the following: Masonry, cut stone, iron work, etc.; roofing, metal work, etc.; ventilating, heating, etc.; carpentry, electrical work, etc.; plumbing, gas fitting, etc.

Hicksville, N. Y.—The St. Ignatius R. C. Church, it is reported, intends erecting a parochial school at a cost of $11,000. Rev. Father Fuchs, Pastor.

Schenectady, N. Y.—Andrew Carnegie has offered to donate $100,000 to Union College for the erection of an engineering building upon condition that the college raise $100,000 for its endowment. Andrew V. V. Raymond, Pres.

Shelby, N. C.—The graded school, which was recently destroyed by fire, it is reported, is to be rebuilt.

Miamisburg, O.—Bids will be received until Nov. 11 by the Bd. Educ., Village School Dist. (Lee Mitchell, Pres.) for furnishing material and erecting a 12-room brick school at Central Ave. and 6th St. Peters, Burns & Pretzinger, Archts., Reibold Bldg., Dayton.

Zanesville, O.—The Bd. of Educ., it is reported, has passed a resolution authorizing the issue of $130,000 bonds for the erection of a high school. An election is to be held Nov. 7th to vote on the question.

**Akron, O.*—It is stated that the School Bd. has decided to accept the bid of Eckart Bros., for steam heating North Hill School at $4,383.

Cincinnati, O.—It is stated that $150,000 school bonds have been sold.

Tiffin, O.—The Ohio Synod of the Reformed Church, it is stated, has accepted the offer of Andrew Carnegie to donate $25,000 toward the erection of a library at Heidelberg Univ., provided another $25,000 is raised.

Greenville, S. C.—It is reported that plans are being prepared for a $20,000 library which is to be erected at Furman Univ. E. M. Poteat, Pres.

Paris, Tenn.—R. H. Hunt, of Chattanooga, Tenn., it is reported, is preparing plans for a $30,000 school, which is to be erected here. W. C. Johnson, Chmn. Bd. Trus.

Wauwatosa, Wis.—School bonds, amounting to $12,000, it is stated, have been sold. The proceeds are to be used to erect a school in Dist. No. 12 bet. the towns of Wauwatosa and Greenfield.

*John Dibbink, of Milwaukee, it is stated, has secured the contract to erect the school in Joint Dist. No. 12 of Wauwatosa and Greenfield at $14,240.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Kansas City, Mo.—J. E. Root, of Minneapolis, Minn., is reported to have presented to Council a proposition to install the Decaire system in Kansas City for the incineration of garbage.

Perth Amboy, N. J.—Chas. M. MacWilliam, City Clk., writes in regard to the construction of a garbage crematory, that the matter has been suggested, but nothing has been done as yet officially.

Brooklyn, N. Y.—The following are the bids opened on Oct. 20 by J. McG. Woodbury, Comr. of Street Cleaning, N. Y. City, for the removal of snow and ice in Brooklyn Boro: (price given per cu. yd.) (Bidders of Brooklyn unless otherwise stated): Wm. Bradley, 86th St. and Bway., N. Y. City, 18 cts.; Chas. Hain, 118 Prospect Park West, 27 cts.; Donlon Contr. Co., 84 Bway., 21 5-6 cts.; McDermott & Foxton, East N. Y. Ave., 28 cts.; O'Grady Bros., 23 cts.; Hill & Hayes, 23 cts.; Norton & Gorman, 303 Douglas St., 22 cts.; Bracken, MacAveney Co., 67th St., Bay Ridge, 20⅜ cts.; Newman Constr. Co., 1127 Willoughby Ave., 19 9-10 cts.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Crompton-Knowles Loom Works, Worcester, Mass., will begin at once the erection of a 5-story addition to its present plant, according to local newspaper reports. The new building will cost $40,000, and will be ready for occupancy by the middle of December.

The silk mill owned by D. E. Adams, Athol, Mass., which was recently destroyed by fire, will be rebuilt, according to local newspaper reports.

The United States Cast Iron Pipe & Fdy. Co., Scottdale, Pa., is contemplating the erection of a large addition to its plant. Plans have not yet been perfected.

The Dawson Coal, Coke & Ry. Co., Dawson Springs, Ky., is contemplating installing a plant to handle 2000 tons of coal per day. Before this plant can be started it will be necessary to build 20 miles of railroad.

The J. L. Taylor Dredge Mfg. Co., Royal Center, Ind., is looking for a site for its proposed new plant, which is to cost $30,000. The main structure will be of concrete, measuring 60 x 300 ft. J. L. Taylor is president of the company.

Stockton (Kan.) Milling Co. will in the spring replace its recently burned plant with an elevator of 20,000 bushels capacity, and a flour mill having an output of 150 bbls. per day.

M. L. Hadley Mfg. Co., whose plant at Manchester, Vt., was recently burned, is establishing a new plant at Hartford, Vt., where the company has secured control of extensive water power.

Fairmont (Minn.) Cement Stone Mfg. Co. is engaged in the erection of a new plant, to measure 100 x 50 ft. Complete equipment for the manufacture of cement products will be installed.

Mutual Mfg. Co. will establish a plant at Neosho, Mo., for the manufacture of farm wagons and other agricultural implements. E. R. Moses, Great Bend, Kan., is president of the company.

Wyman & Co., Johnson City, Tenn., whose planing mills were recently burned, will rebuild in the near future. Capacity of new plant not yet determined.

Mr. R. E. Briesenick, Brunswick, Ga., is erecting a sheet metal works at Valdosta, Ga., for the manufacture of copper turpentine stills. Later, machine shop, foundry and boiler works will be added.

Willow Springs Brewing Co., Omaha, Neb., has begun the erection of a new cold storage plant, upon completion of which work will be begun on a new brew house, to be equipped with 300-bbl. kettle.

Wm. J. Lemp Brewing Co., St. Louis, Mo., is erecting a barley and malt elevator, to have a capacity of 700,000 bushels. The new building will be entirely fireproof, the construction being of tile, brick and steel.

Strong & Northway Mfg. Co., Minneapolis, Minn., mfrs. of mill machinery and supplies, is building a new factory and warehouse, measuring 66 x 140 ft., 3 stories and basement. Plant will be electrically operated.

Cleveland (O.) Furnace Co. will build a new plant shortly, though plans have not yet been completed.

Pyramid Portland Cement Co., Kansas City, Mo., recently incorporated with a capital of $700,000, will shortly begin the erection of a 1,200-bbl.-per-day plant. Electric power with individual motor drives will be used. No machinery ordered as yet.

Geo. D. Witt Shoe Co., Lynchburg, Va., is having plans prepared for a new factory building, to measure 150 x 50 ft., 6 stories. Power plant of 150 to 200 h.p. will be required.

Mr. W. J. Willingham, Tifton, Ga., will erect a new saw and planing mill; 25-h.p. equipment will be installed.

Couple-Gear-Freight-Wheel Co., Grand Rapids, Mich., is erecting a new plant for the manufacture of electric trucks and wagons. The new building will be 50 x 200 ft., with additions for boiler and engine room, shipping room and blacksmith shop. A portion of the equipment is yet to be ordered.

The Brantford (Can.) Screw Co. is contemplating building a large addition to its present plant. Details not yet completed.

The Marinette & Menominee Paper Co., Menominee, Wis., will replace its recently burned plant by a new plant having a considerably larger capacity than the old one, according to local reports.

Mr. John Smith, Gravesville, N. Y., has purchased mill property at that point and will establish a plant for the manufacture of paper bags, according to local reports.

Mr. Peter G. Thomson, Cincinnati, O., is reported to have secured a site near Asheville, N. C., upon which he will erect a paper mill and electric light and water system, to cost $1,200,000. A large tract of land has been purchased for the establishment of a town for employees.

Syracuse (O.) Paper & Pulp Co. will build a large addition to its plant in the spring, according to local reports.

The Automatic Screen Co., Grand Rapids, Mich., is having plans prepared for a large plant to be established in Toledo, O., according to local newspaper reports.

The Pitman-Myers Co., Indianapolis, Ind., have completed arrangements for the erection of a laboratory and factory for the manufacture of chemicals, according to local newspaper reports.

Mr. T. V. Cashen, Jacksonville, Fla., will rebuild his recently burned saw mill plant, according to local newspaper reports. The new mill cost about $30,000.

The National Steel & Wire Co. will shortly begin the erection of a $2,000,000 plant in Los Angeles, Cal., according to local newspaper reports.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

San Luis Obispo, Cal.—The citizens of San Luis Obispo County are reported to have voted in favor of constructing 3 public wharves; one at Port Harford, another at Cayucos and the third at Cambria.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received until Nov. 28 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the Navy Yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies as follows: Schedule 200, drills, sand belt machine, Cincinnati drill, wrought iron pipe and ells. Schedule 202, steel, surface plates, etc. Applications for proposals should designate by numbers the schedule desired. H. T. B. Harris, Paymaster Gen., U. S. N.

Pensacola, Fla.—See "Public Buildings."

Chicago, Ill.—The State Supreme Court is reported to have given possession of 58,832 sq. ft. of land on the west bank of Chicago River, to the Sanitary Dist., which it is stated will remove all obstacles to the widening of the Chicago River bet. Madison and Van Buren Sts.

Pomona, Ill.—Bids will be received by A. W. Wilson, Secy. Cave Valley Land & Cattle Co., Peoria, for digging about 5 miles of dredge ditch on the ranch of this company at Pomona, as advertised in The Engineering Record.

Sycamore, Ill.—Bids will be received until Nov. 13 by E. L. Spring, City Clk., for installing a first-class fire alarm system, consisting of not less than 10 alarm boxes, 3 indicating boards, copper wire and all necessary appliances and attachments.

Whiting, Ind.—The Standard Oil Co. is reported to have decided to expend about $3,000,000 in constructing a pipe line from Kansas to Whiting.

Muncie, Ind.—John S. Ellis, Co. Comr., writes that bids will be received by the County Auditor until Nov. 8 for an elevator for the court house, to cost from $4,000 to $5,000.

Marshalltown, Ia.—W. E. McLeland, Co. Aud., writes that G. W. La Plant, of Marshalltown, on Oct.. 10, submitted the following bid for constructing 4¾ miles of ditch and main in Drainage Dist. No. 2. He bid for 18,000 cu. yd. wet bottom land, open ditch, 10 cts., and 9,000 cu. yds. at 13 cts., and 9,000 cu. yds. of cleaning and widening of old ditch, 14 cts.

New Orleans, La.—The Sewerage and Water Bd. is reported to have decided to ask for bids for the introduction of a lined sub-channel in the bottom of Dublin and 17th St. canals.

**Baltimore, Md.*—The Otis Elevator Co., of New York, N. Y., has secured the contract for the passenger and freight elevators for the U. S. Custom House at Baltimore (bids opened Sept. 26) for $14,570.

Cambridge, Mass.—See "Bridges."

**Moorhead, Minn.*—John Eid, Co. Aud., writes that the contract for constructing ditches Nos. 2 and 3 (bids opened Oct. 19) has been awarded to Wold & Feiger, of Glyndon, for $20,072.

Duluth, Minn.—The Duluth, Missabe & Northern R. R. Co. (H. L. Dresser, Ch. Engr., Duluth) is reported to have decided to construct an ore dock at Duluth, to cost about $600,000.

**Olivia, Minn.*—H. J. Lee, County Aud., writes that the contract for constructing Ditch No. 22, approximately 70,607 cu. yds. (bids opened Oct. 16) has been awarded to Jerry Sherwood, of Litchfield, for $10,650.

**Crookston, Minn.*—N. A. Hoffard, Co. Aud., writes that the contract for constructing ditch 55 (bids opened Oct. 20) has been awarded to Tallef B. Landsverk, of Fosston, for $5,665. Jas. Cummings, of Mallory, Minn., secured the contract for constructing Ditch 57 for $2,629.

**Nebraska City, Neb.*—Frank Peterson and others have entered into a contract with A. M. Munn, of Nebraska City, for the draining of a lake near Bertrand, Neb. The lake covers 440 acres and is 7 ft. deep. The lake is to be drained through earthenware pipe laid through a hill, and discharging into the head of a ravine. Average cut, 30 ft.

Lincoln, Neb.—The following are the bids opened on Oct. 19 by the Superv. Archt., Treas. Dept., Washington, D. C., for the installation of an electric passenger elevator and hydraulic lifts in the U. S. Court House and Post Office at Lincoln: Otis Elevator Co., New York, N. Y., $9,790; Broderer Electric Mfg. Co., Milwaukee, Wis., $10,750, and Marine Engine & Machine Co., New York, N. Y., $11,480.

Bids were opened by the Superv. Archt., Treas. Dept., Washington, D. C., on Oct. 23 for the vacuum cleaning system complete for the U. S. Post Office at Lincoln; Vacuum Cleaning Co., New York, N. Y., $8,250, and Iowa Sanitary Cleaning Co., San Jose, Cal., $4,050.

Ft. Mott, N. J.—Bids will be received by Capt. Louis F. Garrard, Q. M., U. S. A., Delaware City, Del., until Nov. 23 for raising roof of tank room and installing 4 new air tanks at Ft. Mott, as advertised in The Engineering Record.

Paterson, N. J.—H. J. Harder, City Engr., writes that it is proposed to issue $200,000 bonds for the purpose of dredging the Passaic River through this city.

New York, N. Y.—The following are the bids opened on Oct. 17 by Col. W. R. Livermore, Corps Engrs., U. S. A., for dredging channel between Staten Island and New Jersey (price given per cu. yd.): Taylor Dredging Co., 21 State St., N. Y. City, 20 cts.; P. Sanford Ross, Inc., 277 Washington St., Jersey City, N. J., 15.85 cts.;

**Items marked thus give the names of parties awarded contracts.*

The International Contr. Co., 10 Battery Pl., N. Y. City, 15.9 cts.; The W. H. Beard Dredging Co., 21 State St., N. Y. City, 25 cts.; Atlantic Dredging Co., 15 Whitehall St., N. Y. City, 23½ cts.; R. G. Packard Co., 130 Pearl St., N. Y. City, 19¼ cts.

Only one bid was received same time and place for dredging each of the other rivers, as follows: Shrewsbury River, J. Marvin Briggs, 17 Battery Pl., N. Y. City, 32 cts. per cu. yd.; Raritan River, the International Contr. Co., 10 Battery Pl., N. Y. City, 25 cts., and South River, same company, 25 cts.

A. F. Chapman & Co., 822 Prudential Bldg., Buffalo, submitted the following bid on Oct. 16 to Col. W. R. Livermore, Corps Engrs., U. S. A., N. Y. City, for constructing and repairing dikes in Hudson River, N Y.: Round pine or spruce piles, per lin. ft. driven, 17¼ cts.; sheet piling, per M. ft., $50.25; round timber, per lin. ft., 11 cts.; square timber, per M. ft., $58; tie rods and screw bolts, per lb., 5.1 cts.; drift bolts, nails and washers, per lb., 5 cts.; large rubble stone, per cu. yd., $1.90 and $1.85; rubble stone, per cu. yd., $1.20 and $1.25; quarry spalls, per cu. yd., $1.20 and $1.10; paving stone, per cu. yd., $1.78; dredged material, per cu. yd., 38 cts.; broken rock, per cu. yd., 35 cts.; dredging, per cu. yd., 28 cts.; concrete, per cu. yd, (blocks for footing), $7.50, and concrete, per sq. yd. (concrete paving), $2. Amount available from appropriation for improving Hudson River, $100,000.

Ambrose C. Driscoll, 306 Noxon St., Syracuse, bid for dredging Wappinger Creek, N. Y., 28 cts. per cu. yd. for 8,571 cu. yds., and John P. Randerson, 755 Madison Ave., Albany, bid for dredging Saugerties Harbor, N. Y., 25 cts. and 16 cts. per cu. yd.; bids opened on Oct. 16 by Col. W. R. Livermore, Corps Engrs., U. S. A., N. Y. City.

Bids will be received until Nov. 3 by Maurice Featherson, Comr. Docks and Ferries, for furnishing and delivering about 6,000 cu. yds. of sand; also same date for furnishing and delivering about 1,000 yellow pine piles from 80 to 85 ft. in length; 2,000 60 to 70 ft., and 2,000 50 to 60 ft.

Brooklyn, N. Y.—Bids will be received until Nov. 2 by Nicholas J. Hayes, Fire Comr., New York City, for furnishing labor and material required for additions to the fire alarm telegraph system in the Boro. Brooklyn.

**Dresden, O.*—The State Bd. of Pub. Wks., at Columbus, is reported to have awarded the contract for improving the outlet lock at the northern division of the Ohio and Erie Canal at Dresden to Clinton Bros., of Zanesville, for $10,500.

**Akron, O.*—The State Bd. of Pub. Wks. is reported to have awarded the contract for deepening and widening Ohio Canal from Cleveland to Akron (bids opened Oct. 3) to D. E. Sullivan, of Columbus. The contract calls for the removal of 200,000 cu. ft. of earth and debris at 14 and 15 cts. per cu. ft.

Panama.—See "Water."

Philadelphia, Pa.—Bids will be received until Nov. 18 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing certain underground cables at the navy yard, League Island.

The following are reported to be the bids opened on Oct. 23 by Capt. C. A. F. Flagler, Corps Engrs., U. S. A., for constructing a rehandling machine for dredged material in Delaware Ship Channel: Maryland Steel Co., $84,730 (250 days); Ellicott Machine Co., Baltimore, Md., $85,000 (Mar. 1).

Ft. Myer, Va.—Bids will be received by Capt. B. B. Hyer, Q. M., 13th Cavalry, until Nov. 6, for furnishing 106,000 lbs. carbide at Ft. Myer, as advertised in The Engineering Record.

Guantanamo, Cuba.—Capt. E. H. Schulz, Corps Engrs., U. S. A., Fishermans Point, Guantanamo Bay, Cuba, writes that the following are the bids opened on Oct. 10 for furnishing 6,500 bbls. Portland cement (price given per bbl.): Atlas Portland Cement Co., New York, N. Y., $1.54; Northampton Portland Cement Co., 26 Bway., New York, N. Y., $1.40; Hutchison Cement Co., New York, N. Y., $1.51 and $2.11 (delivered at Guantanamo Bay); Alpha Portland Cement Co., Easton, Pa., $1.53; Vulcanite Portland Cement Co., Philadelphia, $1.49; F. S. Banks & Co., New York, N. Y., $1,839 (delivered at Guantanamo Bay).

Bids will be received until Nov. 21 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Naval Station, Guantanamo Bay, a quantity of naval supplies, including a cement testing machine. Applications for proposals should refer to Schedule 199. H. T. B. Harris, Paymaster-Gen., U. S. N.

PROPOSALS OPEN

For Proposals see pages 56, 58, 60, 62, 64 and 66.

WATER WORKS.

Bids Clos.		See Eng. Record.
Oct. 31.	Well, Pensacola, Fla.	Oct. 14
Nov. 1.	Water wks., Waverly, Minn	Sep. 23
Nov. 1.	Meters, Garfield, N. J Adv. Oct. 28.	Oct. 28
Nov. 3.	Pump sta. chimney, Buffalo, N. Y.	Oct. 28
Nov. 6.	Conduit, Toledo, O.	Oct. 14
Nov. 6.	Main, Valley City, N. D	Oct. 21
Nov. 6.	Steel caisson, Winnipeg, Man	Oct. 28
Nov. 7.	Tank, etc., Ft. Stevens, Ore	Oct. 21
Nov. 7.	Boilers, etc., St. Louis, Mo	Oct. 21
Nov. 8.	Irrig. canal, Mitchell, Neb Adv. Oct. 14 to 28.	Oct. 14
Nov. 8.	Canal work, North Platte, Neb Adv. Oct. 14 to 28.	Oct. 14
Nov. 8.	Boilers, Brooklyn, N. Y	Oct. 21
Nov. 8.	Filter beds, Brooklyn, N. Y	Oct. 28
Nov. 8.	Mains, New York, N. Y	Oct. 28
Nov. 10.	C. I. pipe, Cincinnati, O.	Oct. 14
Nov. 11.	System, East Moline, Ill.	Oct. 21
Nov. 11.	Filters, etc., Panama	Oct. 28
Nov. 15.	Canals, etc., Buford, N. D Adv. Sept. 30 to Oct. 28.	Sep. 30
Nov. 15.	Filter plant, Independence, Kan Adv. Oct. 21.	Oct. 21
Nov. 15.	Water wks. and filtration plant, Milledgeville, Ga. Adv. Oct. 28.	Oct. 28
Nov. 16.	Reservoir, etc., Lebanon, Pa	Oct. 28
Dec. 1.	Water works, Burlington, Wash	Oct. 14
Dec. 1.	Meters, Chicago, Ill.	Oct. 21
Dec. 1.	Water wks., Ballinger, Tex	Oct. 28
Dec. 5.	Dam, Glendive, Mont. Adv. Sep. 16 to Oct. 21.	Sep. 16
Dec. 15.	Canal work, Billings, Mont Adv. Oct. 21 to 28.	Oct. 21
Jan. 1.	Irrig. work, El Campo, Tex	Oct. 7
Jan. 2.	Water wks., Manila, P. I.	Sep. 30
—	Tunnel, c. i. pipe, etc., Harrisburg, Pa. Adv. Oct. 7.	Oct. 7
—	Filter, etc., Yuma, Ariz.	Oct. 14

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 31.	New York, N. Y.	Oct. 28
Oct. 31.	Lake City, Minn.	Oct. 28
Nov. 1.	Cleveland, O.	Oct. 21
Nov. 1.	Brooklyn, N. Y.	Oct. 21
Nov. 1.	Indianapolis, Ind.	Oct. 28
Nov. 1.	Buffalo, N. Y.	Oct. 28
Nov. 2.	Columbus, O. Adv. Oct. 7 to 28.	Oct. 7
Nov. 2.	St. Paul, Minn.	Oct. 28
Nov. 3.	Des Moines, Ia.	Oct. 21
Nov. 3.	Paterson, N. J.	Oct. 28
Nov. 4.	Grosse Pointe, Mich.	Oct. 14
Nov. 6.	North Yakima, Wash Adv. Oct. 21 to 28.	Oct. 7
Nov. 6.	Glendale, O.	Oct. 14
Nov. 6.	Napoleon, O.	Oct. 14
Nov. 6.	Plainfield, N. J. Adv. Oct. 21	Oct. 14
Nov. 6.	Boise City, Idaho	Oct. 28
Nov. 6.	Lawrence, Kan.	Oct. 28
Nov. 7.	Guantanamo, Cuba	Oct. 14
Nov. 7.	Chattanooga, Tenn. Adv. Oct. 14, 21.	Oct. 14
Nov. 7.	Clinton, Ill.	Oct. 28
Nov. 7.	Tipton, Ind.	Oct. 28
Nov. 10.	Aberdeen, S. D.	Oct. 21
Nov. 20.	Webb City, Mo. Adv. Oct. 28.	Oct. 28
Nov. 30.	Baton Rouge, La. Adv. Oct. 28.	Oct. 28
Nov. —.	Rockport, Ind.	Oct. 7
Dec. 11.	Sheldon, Ia.	Oct. 14
Jan. 12.	Manila, P. I.	Sep. 30
—	Kirkwood, Mo. Adv. Sep. 30.	Sep. 30
—	Haddonfield, N. J.	Oct. 14
Feb. 1.	Woodlawn, Ala.	Oct. 28

BRIDGES.

Oct. 30.	New York, N. Y.	Oct. 21
Nov. 1.	Portage, Wis.	Sep. 30
Nov. 1.	Greenville, S. C.	Oct. 28
Nov. 1.	Cambridge, Mass.	Oct. 28
Nov. 2.	Boston, Mass.	Oct. 28
Nov. 3.	Ukiah, Cal.	Oct. 28
Nov. 3.	South Bend, Ind.	Oct. 28
Nov. 4.	Akron, O.	Oct. 21
Nov. 4.	Hoosick Falls, N. Y. Adv. Oct. 28.	Oct. 28
Nov. 6.	San Bernardino, Cal.	Oct. 14
Nov. 6.	Huntsville, Ala.	Oct. 14
Nov. 6.	Cleveland, Miss.	Oct. 21
Nov. 6.	Jamestown, N. D.	Oct. 21
Nov. 6.	Monte Vista, Colo Adv. Oct. 21 to 28.	Oct 21
Nov. 6.	South Bend, Ind.	Oct. 28
Nov. 6.	Tipton, Ind.	Oct. 28
Nov. 7.	Bloomfield, Ind.	Oct. 21
Nov. 7.	Palmyra, Mo.	Oct. 21
Nov. 7.	Fargo, N. D.	Oct. 28
Nov. 7.	Portage, Wis.	Oct. 28
Nov. 8.	South Bend, Ind.	Oct. 14
Nov. 8.	Audubon, Ind.	Oct. 21
Nov. 8.	Vale, Ore.	Oct. 21
Nov. 8.	Welcome, Wash.	Oct. 28
Nov. 9.	Columbus, O.	Oct. 21
Nov. 9.	Jefferson City, Mo.	Oct. 28
Nov. 9.	Ventura, Cal.	Oct. 28
Nov. 20.	Memphis, Tenn. Adv. Oct. 14 to Oct. 28.	Oct. 28
Nov. 20.	Doylestown, Pa.	Oct. 28
Jan. 1.	Pensacola, Fla.	Sep. 30

PAVING AND ROADMAKING.

Oct. 31.	Centralia, Ill.	Oct. 28
Oct. 31.	New York, N. Y.	Oct. 28
Oct. 31.	Centerville, Md.	Oct. 28
Oct. 31.	Franklin, Ind.	Oct. 28
Nov. 1.	Steelton, Pa. Adv. Sept. 2 to Oct. 7.	Sep. 16
Nov. 1.	Cincinnati, O.	Oct. 14
Nov. 1.	Buffalo, N. Y.	Oct. 28
Nov. 1.	Indianapolis, Ind.	Oct. 28
Nov. 2.	St. Paul, Minn.	Oct. 28
Nov. 3.	Buffalo, N. Y.	Oct. 28
Nov. 4.	Norwood, O.	Oct. 21
Nov. 4.	Bisbee, Ariz.	Oct. 21
Nov. 4.	Seattle, Wash.	Oct. 28
Nov. 6.	Crownpoint, Ind.	Oct. 14
Nov. 6.	Cincinnati, O.	Oct. 21
Nov. 6.	Salem, Ind.	Oct. 21
Nov. 6.	Moundsville, W. Va.	Oct. 21
Nov. 6.	Greensburg, Pa.	Oct. 21
Nov. 6.	Kirksville, Mo. Adv. Oct. 28.	Oct. 28
Nov. 6.	Perth Amboy, N. J.	Oct. 28
Nov. 6.	Hannibal, Mo.	Oct. 28
Nov. 7.	Bloomfield, Ind.	Oct. 21
Nov. 8.	Verona, N. J.	Oct. 28
Nov. 9.	Cincinnati, O.	Oct. 21
Nov. 10.	Cincinnati, O.	Oct. 14
Nov. 11.	Cleveland, O.	Oct. 28
Nov. 20.	Webb City, Mo. Adv. Oct. 28.	Oct. 28
Nov. 25.	New Orelans, La.	Oct. 21
Nov. 30.	Baton Rouge, La. Adv. Oct. 28.	Oct. 28
Nov. —	Harrison, N. J.	Oct. 21
Dec. 1.	Mattoon, Ill.	Oct. 21

POWER, GAS AND ELECTRICITY.

Oct. 31.	Washington, D. C.	Sep. 30
Nov. 1.	Chicago Ill.	Sep. 9
Nov. 1.	Roosevelt, Ariz.	Sep. 16
Nov. 1.	Central Islip, N. Y. Adv. Oct. 28.	Oct. 28
Nov. 2.	Roosevelt. Ariz.	Sep. 23
Nov. 3.	Buffalo, N. Y.	Oct. 28
Nov. 6.	Ft. Des Moines, Ia. Adv. Oct. 14 to 28.	Oct. 14
Nov. 7.	Washington, D. C.	Oct. 28
Nov. 8.	Washington, D. C. Adv. Sept. 30 to Oct. 28.	Sep. 30
Nov. 10.	Danville, Pa. Adv. Oct. 28.	Oct. 28
Nov. 16.	Castleton, S. I., N. Y.	Oct. 28
Nov. 18.	Tacoma, Wash.	Sep. 30
Nov. 21.	Washington, D. C.	Oct. 21
Dec. 2.	San Juan, Porto Rico	Aug. 19

BUILDINGS.

Oct. 31.	School, Brady, Tex.	Oct. 21
Oct. 31.	School, Ft. Totten, Willets Point, N. Y.	Oct. 28
Oct. —	City hall, Fargo, N. D	Sep. 30
Nov. 1.	Pub. bldg. plans, Salem, Mass	Sep. 16
Nov. 1.	Schools, Saugus, Mass.	Oct. 21
Nov. 1.	Bus. bldg., Omaha, Neb	Oct. 21
Nov. 1.	School, Baltimore, Md	Oct. 28
Nov. 1.	Plans for city hall, Wausau, Wis	Oct. 28
Nov. 1.	School, Glastonbury, Conn	Oct. 28
Nov. 2.	School, Buffalo, N. Y	Oct. 28
Nov. 3.	Court house, Deadwood, S. D	Oct. 28
Nov. 6.	Remodeling jail, Dekalb, Miss	Oct. 28
Nov. 6.	School, Brooklyn, N. Y	Oct. 28
Nov. 6.	School, New York, N. Y	Oct. 28
Nov. 7.	Htg. post office, Guthrie, Okla. Ter Adv. Oct. 21 to 28.	Oct. 21
Nov. 7.	Htg. hospital, San Jose, Cal	Oct. 21
Nov. 7.	Htg., etc., jail, Bloomfield, Ind	Oct. 21
Nov. 7.	School, Manhattan, Kan	Oct. 28
Nov. 8.	School, Boston, Mass	Oct. 28
Nov. 9.	Court house, Marion, Kan	Oct. 14
Nov. 10.	Post Office, St. Johns, Que	Oct. 28
Nov. 11.	School, Sun River, Mont	Oct. 28
Nov. 11.	School, Miamisburg, O.	Oct. 28
Nov. 14.	P. O. bldg., Colorado Spgs., Colo Adv. Sep. 23 to Sep. 30.	Sep. 23
Nov. 14.	Drill hall, Ft. Des Moines, Ia Adv. Oct. 21 to 28.	Oct. 21
Nov. 15.	School, Cleveland, O.	Sep. 16
Nov. 15.	Plumb. P. O., Burlington, Ia	Oct. 21
Nov. 15.	Jail, Lumpkin, Ga.	Oct. 28
Nov. 15.	Bus. bldgs., Florala, Ala	Oct. 28
Nov. 15.	Pub. bldgs., Tompkinsville, S. I., N. Y.	Oct. 28
Nov. 18.	Htg., Pub. Bldg., Phila., Pa	Oct. 28
Nov. 20.	School, Danbury, Ia.	Oct. 28
Nov. 21.	Post bldgs., Pipestone, Minn	Oct. 28
Nov. 22.	Htg., P. O. Bldg., Evanston, Wyo Adv. Oct. 21 to 28.	Oct. 21
Nov. 27.	Improv., Quarantine Sta., Tampa, Fla.	Oct. 28
Nov. 27.	Hospital, Pensacola, Fla	Oct. 28
Nov. 28.	Jail cells, Kansas City, Mo	Oct. 28
Nov. 28.	Pump house, Ft. Du Pont, Del Adv. Oct. 28.	Oct. 28
Nov. 29.	Post bldg., West Point, N. Y Adv. Oct. 21 to 28.	Oct. 21
Dec. 1.	Dwelling, Wilmington, N. C.	Sep. 16
Dec. 12.	Remodel. capitol, Bismarck, N. D.	Sep. 30
Dec. —	School, Bloomington, Ind.	Oct. 21
Jan. 1.	Hotel, Davenport, Ia.	Sep. 30
Jan. 10.	Library plans, Toronto, Ont.	Sep. 23
—	Bldg. material, Yuma, Ariz	Oct. 14

MISCELLANEOUS.

Oct. 30.	Lumber, New York, N. Y	Oct. 21
Oct. 30.	Improv. garb. incinerator, New York, N. Y.	Oct. 21
Oct. 30.	Stone, New York, N. Y	Oct. 21
Oct. 31.	Dredging, San Francisco, Cal	Sep. 30
Nov. 1.	Garbage franchise, New Orleans, La.	Sep. 16
Nov. 1.	Jetty, Washington, D. C. Adv. Oct. 7 to 28.	Oct. 7
Nov. 1.	Cement, Whalen, Wyo Adv. Oct. 14 to 28.	Oct. 14
Nov. 1.	Canal, Brooklyn, N. Y	Oct. 21
Nov. 1.	Retaining wall, Cincinnati, O	Oct. 21
Nov. 1.	El. ry. franchise, Chico, Cal	Oct. 21
Nov. 1.	Dredging Oyster Bay, L. I., N. Y.	Oct. 21
Nov. 1.	Earth filling, etc., Cambridge, Mass.	Oct. 28
Nov. 2.	Remov. wreck, Newport News, Va Adv. Oct. 14 to 28.	Oct. 14
Nov. 2.	Ry. work, Brooklyn, N. Y	Oct. 21
Nov. 2.	Fire alarm system, Brooklyn, N. Y.	Oct. 28
Nov. 3.	Ammunition hoists, Wash., D. C. Adv. Oct. 7 to 28.	Oct. 7
Nov. 3.	Canal work, Port Huron, Mich Adv. Oct. 14 to 28.	Oct. 14
Nov. 3.	Breakwater, Port Burwell, Ont	Oct. 14
Nov. 3.	Pine and sand, New York, N. Y	Oct. 28
Nov. 4.	Drain, Raymond, Ill.	Oct. 14
Nov. 6.	Garb. disp., New York, N. Y Adv. Sept. 9 to Oct. 28.	Sep. 2
Nov. 6.	El. Ry. franchise, Woodland, Cal	Sep. 30
Nov. 6.	Ditch work, Onawa, Ia Adv. Oct. 21 to 28.	Oct. 21
Nov. 6.	Carbide, Fort Myer, Va Adv. Oct. 28.	Oct. 28
Nov. 7.	Supplies, Guantanamo, Cuba	Oct. 14
Nov. 7.	Boiler, Ft. Brown, Tex	Oct. 21
Nov. 7.	Supplies, Washington, D. C.	Oct. 28
Nov. 8.	Elevator in court house, Muncie, Ind.,	Oct. 28
Nov. 9.	Wharf, etc., Havana, Cuba	Jul. 29
Nov. 11.	Remov. earth and rock, Portsmouth, N. H.	Oct. 21
Nov. 11.	Iron, etc., Panama	Oct. 28
Nov. 13.	Fire alarm system, Buffalo, N. Y	Oct. 28
Nov. 18.	Cables, Philadelphia, Pa	Oct. 28
Nov. 20.	Concrete wall, Chattanooga, Tenn Adv. Oct. 14 to 28.	Oct. 14
Nov. 21.	Supplies, Washington, D. C	Oct. 21
Nov. 21.	Supplies, Guantanamo, Cuba	Oct. 28
Nov. 23.	Tanks, Ft. Mott, N. J Adv. Oct. 28.	Oct. 28
Nov. 25.	Drains, etc., New Orleans, La	Oct. 21
Nov. 27.	Wharf, Pensacola, Fla	Oct. 28
Nov. 28.	Supplies, Washington, D. C	Oct. 28
Dec. 2.	Quay wall, Key West, Fla	Oct. 21
Dec. 2.	Quay wall, Guantanamo, Cuba	Oct. 21
Dec. 15.	R. R., Manila, P. I.	Sep. 16
Jan. 1.	Statue plans, Indianapolis, Ind	Jul. 22
Jan. 9.	Wharf, etc., Auckland, N. Z Adv. Oct. 14 to 28.	Oct. 14
Apr. 2,	'06. Harbor Work, Valparaiso, Chili, Adv. Apr. 29 to Sep. 9.	Apr. 29
—	Grading, Baltimore, Md. Adv. Sep. 30 to Oct. 7.	Sep. 30
—	Ditch work, Pomona, Ill Adv. Oct. 28.	Oct. 28

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